THE INTERNATIONAL SUGAR JOURNAL.

A TECHNICAL AND COMMERCIAL PERIODICAL DEVOTED ENTIRELY TO THE SUGAR INDUSTRY.

JANUARY TO DECEMBER,

1929.

VOLUME XXXI.

LONDON:
ST. DUNSTAN'S HILL, E.C. 3
1929

CONTENTS FOR JANUARY, 1929.

Managing Editor - - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

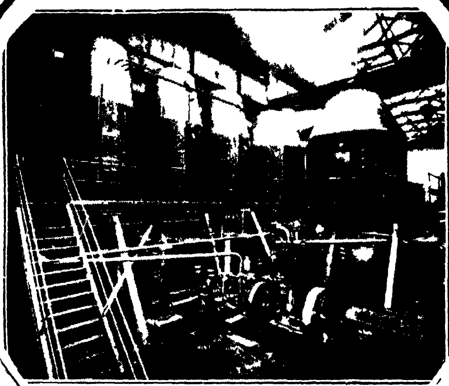
For **INDEX TO ADVERTISERS,** see pages l.—liii

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.



CONTENTS FOR MARCH, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xliv.—xlvii.

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION,
21s., Post Free.

SINGLE COPIES, 1s. 9d.;
2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR APRIL, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlviii.—li.

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR MAY, 1929.

Managing Editor - - - - - **NORMAN RODGER.**

Technical Editor - - **JAMES P. OGILVIE, F.I.C., F.C.S.**

For **INDEX TO ADVERTISERS,** see pages xlviii.—li.

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION.
21s., Post Free.

SINGLE COPIES, 1s. 9d.;
2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR JUNE, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS**, see pages xlviii.—li.

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR JULY, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlviii.—li

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR AUGUST, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlviii.—li.

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR SEPTEMBER, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlviii.—li.

The Journal is published about the 15th of the Month.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR OCTOBER, 1929.

Managing Editor - - - - - **NORMAN RODGER.**
Technical Editor - - **JAMES P. OGILVIE, F.I.C., F.C.S.**

For **INDEX TO ADVERTISERS,** see pages xlviii.—li.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR NOVEMBER, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages l.—liii.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

CONTENTS FOR DECEMBER, 1929.

Managing Editor - - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages l.—liii.

The Journal is published about the 15th of the Month.

Telephone: ROYAL 9808. *Cables:* SUGAPHILOS, LONDON.

ANNUAL SUBSCRIPTION, 21s., Post Free.

SINGLE COPIES, 1s. 9d.; 2s. Post Free.

Cheques and Postal Orders to be made payable to "The INTERNATIONAL SUGAR JOURNAL," and not to individuals.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 361. JANUARY, 1929. VOL. XXXI.

Notes and Comments.

The Outlook for 1929.

The sugar year just ended has proved in most ways a disappointing one for both producer and dealer; the existence of large supplies, the excessive resort in America to invisible stocks, and the consequent retardation of any improvement in the current range of uneconomic prices, have had a depressing effect on the world's sugar industry. Cuba's attempt to organize restriction on a wide scale was another unsettling feature, and as it failed it left the position if anything worse - at any rate for Cuba. It is now left to the League of Nations Economic Committee to see whether they can untie the knot and get the principal world producers to co-operate in avoiding over-production. But progress in that direction will not be rapid.

For 1929 conditions are certainly better at the opening of the year than they were twelve months ago. Invisible stocks are undoubtedly considerably less, and any buying movement to replenish them to the old level would stimulate the market. Prices are uneconomically low and it is impossible to foretell when they will return to a higher level; but at all events they are at about the worst and can hardly be subject to further reduction. The best feature is, however, the fact that consumption is increasing throughout the world; the increase is particularly marked in the United Kingdom, though the figures given on page 55 of this issue are not strictly comparable with last year owing to the statistical changes the 1928 Budget brought along in its train. At the time of writing we do not know what the U.S. consumption has amounted to; but the result will be known this month.

WILLETT & GRAY's latest figures of estimated production for 1928-29 show a slight increase, as compared with last month, of about 100,000 tons, beet and cane. LICHT has since raised his figures of European beet production by some 150,000 tons, due to increases foreshadowed in Germany, Poland, Rumania and France. But taking them as a whole, the increases in world production are no more than it is hoped an increase in consumption will absorb; and it is not impossible that consumption in 1929 will do better than it did in 1928, in which event the relation of production to consumption will assume a more favourable balance.

Sugar Politics at Home.

Since the Budget last April adjusted the sugar duties so radically in favour of Home refined over Foreign, the revival in the fortunes of refining in this country has been very marked. The leading firm, TATE & LYLE (as we show below), have increased their output by fully 50 per cent. and aim at one of 100 per cent. The Greenock refineries secured a welcome reprieve, and two or three of them seem assured of steady work while the present duty incidence continues. The beet factories are hastening to re-adjust their plants to deal with imported raws in the off season, and so work all the year round. The virtual shutting out of the large supplies of Continental white sugars has, on the other hand, dealt a serious blow to those London and provincial brokers who were more or less largely interested in importing that sugar, and it is difficult to see how there can be found any scope for their continuing activity, so long as the vast bulk of the import of sugar is to the account of one refining firm. The benefit to the refining industry itself is of course very marked; and it is interesting to note that, according to LICHT, the Centrale Suiker-Maatschappij of Amsterdam proposes, in the event of the present Conservative Government getting a fresh lease of power at the coming General Election, to transport part of its modern refinery at Oud-Gastel to England and use it as the nucleus of a new refinery in this country, so as to get inside the sugar tariff and neutralize the losses in Dutch exports to England that have been a feature of late months.

Nothing is more illuminating, then, than this intention, *if* the political situation allows. For the continuing satisfactory position of the refiners in this country probably hangs on the results of the elections in the coming summer. If the Conservatives are returned to power once more, then it may be assumed that the refiners will be left to enjoy their more or less complete monopoly *sine die*, and Continental refiners will be induced to come over here and get some pickings with the aid, presumably, of British labour. If, on the other hand, Labour gets a sufficiently big majority to displace the present party from office, everything depends on whether its free-trade section with Snowden at its head will be able to wag the tail, or whether the growing section disposed to abandon a blind adherence to free trade (which includes Mr. J. H. THOMAS with his Imperial sympathies) will prove powerful enough to prevent any precipitate reversal of policy. On these "ifs" hangs the immediate future not only of refining at Home but of Imperial Preference. It is a decidedly perplexing vista, and we shall revert to it in a later issue.

The Present Stage of Beet Sugar Production in England.

In a recent Trade Supplement of the *Sheffield Daily Telegraph*, Mr. ALFRED WOOD, secretary of the Anglo-Dutch group of sugar factories, deals with the present position of the home beet sugar industry.[1] The data compiled of the working of the industry since the Subsidy started show that our growers have achieved an average sugar content which compares favourably with that of foreign countries, but the average yield is disappointing, as it is about three tons per acre lower than the average yield abroad. Many growers have, of course, obtained yields which compare with the best foreign experience namely, from 10 to 15 tons per acre and even up to 18 tons. But the averages have been affected by the number of growers who through lack of experience or the choice of unsuitable land have so far been unsuccessful with the crop. It is therefore clear that attention on the growing side must be largely concentrated on the question of output per acre.

[1] See page 8 for some statistical data given by him.

Notes and Comments.

The second period of the subsidy which commenced with 1928 involved a reduction of about 20s. per ton of beet in a normal year. In the new beet contract for the three years involved, the farmers accept 8s. per ton of this reduction, the factory bearing the remainder *plus* all the risks of the market; while the farmer gets an improved rate of bonus which in the favourable season just closing has resulted in the grower receiving on the average almost the same price per ton of roots as he received in 1927, a year of agricultural disappointment generally. The bad results of 1927, coming just before the first reduction in the subsidy, had the natural result of reducing the 1928 acreage by about 23 per cent. over 1927; poor growers and poor land were to varying extents eliminated. But the results of 1928 have encouraged the recruitment of fresh acreage, and the prospects for 1929 are already promising.

As to the future prospects of the industry, Mr. WOOD remarks that the sugar beet crop has already proved to be of value, if not an essential feature of arable farming in this country. It is also a fair assumption that a factory built on a suitable site in a suitable district could face without anxiety, in the present stage of more mature experience, the difficulties and risks belonging to the present reduced subsidy rate. "At the moment, the efforts of all concerned are concentrated on achieving the purpose of the Subsidy Act, namely, to ensure that the industry, at the end of the ten years period, which expires in 1933, shall continue on permanent lines without further State assistance. Although it is too early to forecast with certainty the economic environment of an industry the value of whose finished product is determined by world conditions, it is hoped to prove the wisdom of Parliament in deciding that the State assistance shall recede during each period by definite steps, compelling a steady intensification of effort in the direction of economic independence."

Sir Benjamin Morgan and Empire Trade.

Last month the Sugar Federation of the British Empire gave a public luncheon, at which they welcomed back from a world tour their Chairman, Sir BENJAMIN MORGAN, and his wife. At the function, which was attended by a distinguished company of those interested in Empire development, tributes were paid by the DUKE OF SUTHERLAND, by Sir PHILIP CUNLIFFE-LISTER of the Board of Trade, and by Mr. AMERY of the Colonial Office, to Sir BENJAMIN'S work in the past for the Empire movement. During the War he was Chief Technical Adviser to the Labour Department of the Ministry of Munitions and the Ministry of National Service, and in that position he was a very able adviser and executive officer whose knowledge of the manifold varieties of industry was of the greatest possible value to the country at that time. Sir BENJAMIN MORGAN was also Chairman for ten years to 1921 of the Trade and Industrial Committee of the Royal Colonial Institute. It was therefore fitting that he should have been chosen to carry out a mission to the principal Dominions of the Empire with a view to urging producers to treat the Empire as an economic whole. In the course of his travels he visited Canada, New Zealand, Australia, and South Africa, in each of which he went closely into the problem of reciprocal trade with the mother country and other Dominions and Colonies. Everywhere he strongly urged the cause of British goods, and in those sugar areas which benefit from the sugar preference duty in the United Kingdom he put the case for reciprocally preferring British sugar machinery. In one Dominion, he told us, a millowner who was about to place an order for a foreign sugar mill was led to abandon the idea and instead to invite tenders from British manufacturers. Sir BENJAMIN added he was very much impressed with the amazing growth of the sugar industry of Queensland and

Natal, which in his view could easily be extended to double the output in both areas. Unfortunately the present low price of sugar is an obstacle to rapid expansion ; but a further preference of £2 per ton on their sugar entering this country, if the Government would concede it, would be of considerable assistance in accelerating progress.

Sir BENJAMIN MORGAN'S views of the prospects for further Empire reciprocity are perhaps best summed up in his report to the Council of the Federation. Giving his impressions of conditions in the Dominions he stated that under whatever difficulties, financial and economic, the Dominions were labouring, he was optimistic concerning the future ; but it was essential that there should be further extensions of preference on both sides if we were to provide the market for their goods and they were to continue to purchase our manufactures. He thought we could not go on any longer with voluntary preferences, and that they would have to be replaced by reciprocal commercial agreements negotiated in the ordinary way. Imperial preferences were now effective in some parts of the Empire and not in others, and many of the preferences given to British manufacturers in Dominion tariffs were only partly effective. We could only get to a condition of maximum co-operation by negotiated preference. The work of the Empire Marketing Board was immensely appreciated Overseas, but some assistance was required from that Board and from the Department of Overseas Trade to organize shopping weeks for British manufactures in the Dominions.

The Coimbatore Canes in India.

Elsewhere we give the gist of an interesting paper read before the Royal Society of Arts by Sir JAMES MACKENNA, C.I.E., on the Indian Sugar Industry —its past achievements and its future problems. Therein tribute is very properly paid to the influence that has been achieved by the Coimbatore seedling canes first bred at the Coimbatore station when Dr. C. A. BARBER was in charge of the sugar cane experiments there. Their introduction, we are told, has completely revolutionized the position so far as the Indian white sugar industry is concerned, and upon their further spread depends largely the extension of sugar refineries in northern India. Fortunately, the Coimbatore seedlings appear to be entering the phase of rapid development in that part of India, the acreage under them being estimated during the past three seasons at 24,000, 60,000, and 150,000 respectively. This is specially encouraging, because the correspondent who gives us the last figure writes as follows : "The extension of these canes is increasing, but the ryot is slow to move, and we ourselves have only obtained action by growing the cane and distributing the seed free." The following local figures which he sends are of interest as indicating the revolution that is taking place in certain areas in the displacement of those canes formerly grown by the Co seedlings. Co 210, 835 acres yielding 15·9 short tons of canes per acre ; Co 213, 1201 acres with 15·7 tons per acre ; and Co 214, 461 acres with 11·4 tons per acre. The local Hemza provided 176 acres with 10·1 tons of cane per acre. These figures do not of course give the amount and value of the sugar per acre made from these four canes ; in estimating that, account must be taken of the superiority of the juice of the new canes and the fact that they ripen a good deal earlier. But even without these other factors, the superiority in yield as figured above is very striking.

Sugar Cane Technologists' Congress, Soerabaia, 1929.

Further particulars besides those we gave last month[1] of the Congress to be held at Soerabaia, Java, by the International Society of Sugar Cane Technologists in June next are to hand. The Congress will open on the 6th

[1] *I.S.J.*, 1928, 629.

of that month and the two following days will be devoted to a general session. Three days will be given to sectional meetings and a final day will be devoted to a general meeting terminating the Congress. Seven days more will be spent on excursions to see irrigation works, to the Pasoeroean Experiment Station, and to various sugar factories.

For the sectional meetings a tentative list of subjects to be discussed has been drawn up and various speakers have been invited to read papers on them. These subjects include : A method of determining damage by and combating the most important insect pests of the cane ; Cytological analysis of the genus Saccharum ; Present stage of cane breeding work ; Experimental stations and results obtained ; Tilling for cane planting : Diffusion combined with mill-pressing ; Maceration combined with mill-pressing ; Milling systems with a large number of rolls ; Cane cutters, crushers, shredders, grooved mill rollers ; Theoretical basis of juice extraction ; Uniformity in reporting factory data ; Measuring and weighing ; Boiler station problems ; Crystallization from impure sugar solutions ; Crystallization of non-sugars together with sucrose ; Boiling pans ; Condensation plants. The list is a very comprehensive one, and the factory side of the industry is well to the fore.

The committee appeals to all members to assist in making the congress a success. All correspondence pertaining to it should be addressed to the Proefstation voor de Java-Suikerindustrie, Pasoeroean, Java. Intending participants are requested to notify the Committee before May 1st next of their desire to attend, so that arrangements can be made for their accommodation. We would express the hope that more British representatives will be enabled to attend than has been the case at past congresses, and that Governments or institutions in the countries concerned will afford facilities for the necessary leave and travelling expenses to their sugar officers, to whom the chance of a visit to the Java sugar industry cannot fail to be of great educative value and lasting benefit.

Tate & Lyle's Improved Year.

At the annual meeting of Messrs. Tate & Lyle, Ltd., the sugar refiners, which was held last month, the President, Sir E. W. TATE, Bt., had naturally some interesting figures to give the shareholders of the increased profits and the improvement in prospects generally, as a result of the Budget changes of last April. As a result of virtually shutting out foreign refined sugar, all British refineries are now working a much larger output. In the case of Tate & Lyle, their three refineries which before the Budget were melting 14,500 tons weekly have since April melted an average of 22,000 tons weekly, or an increase of 50 per cent., and the full weekly capacity of these refineries is now 25,000 tons (or say 1,250,000 tons per annum.) Even this output is to be increased, and the firm hope before long to melt not far short of 30,000 tons weekly. With regard to the future, Sir ERNEST TATE remarked that if they could be certain of a continuity of the present Governmental policy, the British refiners—together with the Home Grown sugar makers—would be in a position to supply the whole of the requirements of the United Kingdom at a price equivalent to the market price of the world. The home beet factories were already benefiting from the Budget changes by their new ability to refine imported raw sugar during the off-season and it is estimated that they melted over 53,000 tons of sugar in 1928. Fortunately, the British sugar refiners and the home beet industry are now working in harmony.

Apropos of the above figures of refining output, it is mentioned by GOLODETZ that the remaining refineries, plus the five or six Home beet factories refining raws in the off season, can be counted upon to provide a further melting capacity of at least 600,000 tons. We then would have, refined at home, a total of some 2,100,000 tons raw basis or 1,900,000 tons refined, which would more than satisfy the whole of the U.K. consumption. But in practice this maximum capacity may not be achieved so readily as it is stated in theory.

The Glasgow Sugar Machinery Market during 1928.

In its annual Trade Review for 1928, the *Glasgow Herald* observes that there was a serious decline in the selling price of sugar last year with a consequent effect on the purchasing powers of the sugar factories, and a restraint on the development of the industry in new fields. As a result, the demands for new machinery, or for plant to extend existing factories, and even orders for replacements, were adversely affected,and the work placed with Glasgow firms was disappointingly short. Orders were, however, obtained, some of them in keen competition with United States and Continental firms ; of course, at keenly cut prices.

Glasgow firms, always alive to the necessity for keeping to the forefront, introduced some new features in equipment, tending mainly to securing a greater recovery of sucrose throughout the manufacturing process of sugar. These, together with the fact that cane sugar machinery can still, in many cases, be manufactured and shipped at prices slightly below United States quotations—the keenest competitors in the Western market--afford a reasonable feeling of confidence throughout the trade in Glasgow.

Inquiries received and general indications of business in India, Australia, South Africa, and elsewhere, give reason to hope that in the near future orders for a moderate amount of work will be placed in Great Britain from these sources. It is interesting to note that British manufacturers can still compete successfully for the Australian market, in spite of the very high tariff imposed in favour of the Australian manufacturers of sugar machinery. Taking the outlook as a whole, however, the prospects of work provide little warrant that 1929 will prove substantially better than 1928.

The Outlook for Java Sugar.

According to GOLODETZ's Market Review, the Java market is in a healthier condition than was anticipated. The central selling organization, the V.J.P., sold the remainder of the current production, namely about 250,000 tons, to an important Java concern of exporters at, it is alleged, 12½ guilders per 100 kilos (10s. 6d. per cwt.) if placed in the Far East, or 11 guilders (9s. 3d.) when shipped West of the Suez Canal. That concern in its turn has marketed of the purchased quantity a total of 178,000 tons for consumption in the Far East at 13⅛ and 13¼ guilders, and was said to hold at December 31st the remaining 72,000 tons for 13¾ guilders. December shipments from Java are estimated to amount to about 350,000 tons. If this figure be confirmed, the exportable surplus of the current Java production at the turn of the year should total 580,000 tons, as against 485,000 tons a year ago. The excess of about 100,000 tons is, however, partly an illusory one, since the present carry-over is supposed to include some indefinite but important quantity sold to Europe for shipment in the New Year, as against barely 25,000 tons a year ago. Further developments during the first four months of the year, quite apart from shipment of sugars to Europe, may turn out to be of a bullish nature. During January to April, 1928, total shipments from

Java amounted to 456,000 tons, of which 230,000 tons went to India. A reliable and most authoritative source, so far as Indian sugar trade is concerned, predicts the requirements of India from Java at 300,000 tons for the first three months of 1929, as against 210,000 tons in 1928. On that basis, the current Java production is likely to disappear entirely before new sugars make their appearance at the end of April.

Connal & Co.'s Annual Sugar Trade Review.

From the Annual Review of the Home Sugar trade prepared by Messrs. William Connal & Co., the Glasgow brokers, we take the following excerpts :

"The past year has been of the deepest importance to British sugar refiners, and to all otherwise interested in the sugar industry. The unsatisfactory condition of British sugar refineries had for long become a matter of serious consideration. The competition of home grown beetroot sugars, and the active, and ever increasing, competition of foreign refined, had proved very disastrous, in so much so that two important refineries in Greenock had been compelled to shut down for the time being. The gravity of this situation compelled refiners to make active representation to the Government for such assistance as would prevent their ultimate ruin. As these representations had been sympathetically received, it was hoped that the Chancellor of the Exchequer, in his budget of 24th April, would indicate the relief which Government might see fit to propose for their protection. In this they were not disappointed, as the Chancellor then announced that they would be given a reduction of 2s. per cwt. on all the raw sugar used in their refineries, and that, with some minor conditions, immediate effect would be given to this resolution.

"This allowance made them was highly appreciated by the U.K. refiners, as it enabled them at once to undersell all competitors of foreign refined. The same statement made by the Chancellor in favour of the refiners proved, however, the 'death knell' of the important business of many London and provincial brokerage firms who had been largely engaged in the sale of foreign granulated. U K. refiners were now, however, enabled to monopolize all British markets to the extinction of foreign refined. The foreign sugars most affected by this change were those of Czecho-Slovakia. They were of excellent quality, much liked by the British trade, and their sale had become a very important business to many firms engaged. The outturn of the Czecho refineries was about 1,000,000 tons per annum, and more than half of this was available for export, principally to the British market. It is not, therefore, to be wondered at that this unexpected turn of events was received by them with the utmost consternation.

"U.K. refiners, availing themselves of their good fortune, immediately began to increase their weekly outturn, both in London and Liverpool. Refiners hope, very shortly, to have so increased their weekly outturn as to meet all demands of present and increasing consumption.

"In Greenock at the beginning of the year the Berryyards refinery of the Westburn Sugar Refineries, Ltd., was the only one melting,.but early in May Messrs. John Walker & Co. re-opened their refinery. There are rumours that the Glebe Sugar Refining Co. may again be melting soon.

"The Cupar beet factory was equipped with plant for the refining of foreign raws, and it is understood the quantity melted there was about 20,000 tons in the period between the Budget and the start of the autumn beet campaign. When the beet crop is finished, the refining of imported raws will be resumed."

The Beet Sugar Industry in Great Britain.

Table A.

Incremental Progress of Sugar Factory Capitalization and Construction.

	Including 1924	1925	1926	1927	Total
Factories constructed each year	3	7	4	3	17
	£	£	£	£	£
Share capital issued each year	755,970	1,682,538	803,520	1,236,135	4,478,163
Debentures, etc., issued each year	387,069	740,902	1,649,019	less 164,765	2,612.225
Other loans issued each year	—	709,285	less 327,956	less 270,910	110,419
Capital expenditure each year	1,016,854	3,001,140	1,542,057	2,186,539	7,746,590
Provision for depreciation each year	69,172	110,743	424,159	746,862	1,350,936
Percentage written off to date (cumulative)	6·8	4·2	10·7	17·5	17·5
Factories—cost less depreciation to date	947,682	3,838,079	4,955,977	6,395,654	6,395,654

Table B.

Summary of General Results Obtained for Manufacturing Seasons 1924-25 to 1927-28.

	1924-25	1925-26	1926-27	1927-28
Acreage under sugar beet	22,637	56,243	129,463	232,918
Tonnage of beet delivered to factories	183,713	431,185	1,117,072	1,503,019
Average yield of washed and topped beet per acre (tons)	8·10	7·67	8·63	6·45
Average price paid per ton of beet	52s. 4d.	55s. 6d.	59s. 5¾d.	55s. 4½d.
Estimated total sum, including transport, paid by factories to growers	£480,000	£1,196,000	£3,322,000	£4,147,000
Average sugar content of beets (per cent.)	16·65	16·36	17·31	16·12
Total production of sugar (cwt.)	478,308	1,035,672	3,069,757	*3,802,189
Total production of dried pulp (tons)	7,510	21,795	62,800	91,436
Total subsidy paid (sugar and molasses)	£509,200	1,121,581	£3,325,393	*£4,214,100
†Total Excise Duty recovered	£229,961	£370,001	£1,007,217	£1,314,784

* Subject to slight adjustment. † Financial year figures. Campaign figures not available.

Table A is prepared from the annual White Paper laid before Parliament under the terms of the Subsidy Act. *Table B* is from data furnished by the Ministry of Agriculture and Fisheries. The two are taken from an article by Mr. Alfred Wood appearing in the *Sheffield Daily Telegraph*. (See page 2).

Mauritius.

Department of Agriculture Report for 1927.

The annual Report of the Department of Agriculture of Mauritius for the year 1927, as prepared by Dr. H. TEMPANY, contains the usual considerable section devoted to the sugar industry. The following are the chief particulars which we cull from its pages.

The factory results for the 1927 crop so far as they could be known at the time of the Report gave a total of 216,400 metric tons of sugar, against a forecast of 243,000 tons, which is a reduction of some 8 per cent. on a normal crop of 235,000 tons. Very considerable disappointment was experienced in the tonnage harvested, especially in the eastern and southern districts. The extraction of sugar per cent. of cane was somewhat below average, being 10·45, but well above the low figure of 1926 of 9·94 ; it was however decidedly below expectations, having regard to the favourable weather conditions experienced. Cane returns were below anticipations especially in respect to ratoons, and in some instances juices were weak. There was a somewhat marked increase in the prevalence of disease, particularly gumming on the White Tanna cane ; this cane occupies about 60 per cent. of the area cultivated, and it is being feared that where unfavourable conditions prevail it is becoming easily infested with parasitic organisms.

The estimated production of 216,400 metric tons compares with 192,590 tons in 1926 and 241,220 tons in 1925. In 1920 the total was as high as 259,870 tons. Fully 99 per cent. consisted of vesou sugars, but the anticipation of much better market conditions for "extra fine" granulated, as compared with ordinary vesou, was not in general substantiated, and it is doubtful whether further efforts will be made towards increasing the production of this extra fine brand.

Factory conditions.—One more factory will probably be closed after the 1927 campaign, thus reducing the total number of factories to 43. New sugar machinery to the value of Rs. 1,087,302 was imported during the year, and tramway material to the value of Rs. 418,620.

Area under cultivation.—At the end of 1926 the area under cultivation approximated to 162,100 acres ; of these, estate cultivation accounted for 99,600 acres, while plantations off estates approximated to 62,500 acres. Incidentally, the area cultivated by Indian sugar planters approximated to 72,500 acres, or 44·7 per cent. of the total under cane.

Disposal of the sugar crop.— The Sugar Planters' Syndicate continued operations during the year, controlling more than 80 per cent. of the sugar production of the Colony. The average sale price per 50 kilos for 1926 was Rs. 11·63 net. The distribution in grades of the total sold was as follows :- Extra fine, 11 per cent. ; Grade A vesou, 87 per cent. ; Grade B vesou, 2 per cent. ; the difference in sale price between the various grades being Rs. 0·50 per 50 kilos. For 1927, the preliminary figure for the average sale price approximates to Rs. 9·72 net per 50 kilos. In the net sale price for 1926, account is taken of the increase produced by the Government loan of Rs. 5,000,000, which is equivalent to a surplus value of about Rs. 1·32 per 50 kilos, on a total production of 190,000 tons of vesou sugars. As during previous years, the bulk of the sugar production went to the United Kingdom. Figures for the 1926-27 export year are as follows : Total export, 187,084 metric tons ; export to the United Kingdom, 181,272 metric tons. Up to the end of 1927, the total sugar export amounted to 123,600 tons, of which 110,100 went to the United Kingdom.

Instrumental cultivation.—Tractors and ploughs to the value of Rs. 70,535, as against Rs. 67,000 in 1926, were imported into the Colony in 1927. There

are at present 111 tractors in operation in this island, most of which are Cletracs. There is little to add concerning the use of implements in Mauritius this season, the position being approximately the same as that shown in last year's report.

Irrigation of the sugar cane.—Distribution of water was commenced from the new reservoir at "La Nicolière," while work was continued on the reservoir at Midlands which forms part of the large scale project for irrigation in the North-Western area. In order to bring about improvement in irrigation methods, the appointment was sanctioned of an Agricultural Irrigation Officer, whose duties will be concerned with endeavouring to bring home to planters the importance of rational methods of applying irrigation water, as summarized in the annual report of 1926.

Pests and diseases of the sugar cane.—A further centre of infection of *Phytalus Smithi* was recorded at the end of the year in Flacq. The multiplication of foci in this way is inevitable, given the extensive traffic which takes place throughout the Island, and eventually the infection of the whole area with Phytalus appears inevitable. It is estimated that the area infected amounts approximately to 41,000 acres or 25 per cent. of the total area cultivated in cane. The area on which actual damage is being experienced with the pest is however limited to about 2500 acres.

The control measures adopted are primarily responsible for this position, and of these the work of the introduction of parasite *Tiphia parallela* is the most important. In centres of intense infection, the application of hand collection methods for adult insects and also larvae has continued to give good results. During the year experiments with Cyanogas (a very powerful insecticide) applied to virgin canes infected with Phytalus yielded results which appear promising.

During the year it became apparent that considerable damage was being occasioned to canes owing to the extensive prevalence of the gumming disease. Since 1925 the disease had been observed to be present in increasing quantity, and during the crop of 1927 a detailed survey of the canes from all over the Island was made by the Department of Agriculture. The result of the survey indicated that the disease was present to a much greater extent than was previously supposed. It was shown that the Big Tanna cane which is cultivated on 56 per cent. of the total area is by far the most affected, the average percentage of infected canes being as high as 15·0 per cent. There seems to be good reason to believe that the reduction in the yield experienced for the crop of 1927 may largely be attributable to this cause. The situation was reviewed by the Director of Agriculture in an address delivered before the Chamber of Agriculture in December. The remedies are simple and consist chiefly in paying careful attention to selection of planting material and to the cultivation of resistant varieties. As a result of the steps taken, greatly increased interest has been aroused among planters in the question of the plantation of varieties other than White Tanna, and a considerably increased demand was seen for the new varieties introduced or raised by the Department of Agriculture during the past few years.

Red Rot has also been in evidence though to a less extent than Gummosis. The varieties M.P. 55 and 131 have shown marked susceptibility to the disease, while the susceptibility of White Tanna to this malady is less. There is no doubt that the question of finding an improved variety of cane is of vital interest to the sugar industry of the Colony.

Investigations in relation to the sugar industry.—The ordinary investigations carried out by the Department of Agriculture have been continued,

including the raising and trial of new seedling canes, and manurial trials with cane.

The results of 13 years' experiments on the manuring of canes in Mauritius were published in bulletin form in the year, as also were the results of the experiments with seedling canes. The main conclusions to be drawn from the experiments with manures are summarized below :—

1. Mauritius planting practice under the best conditions comprises manuring with heavy dressings of *fumier*, 20 to 30 tons per acre, to virgin canes combined usually with heavy dressings of molasses or scums or both, to which are added further dressings of artificial manures usually containing nitrogen as sulphate of ammonia or sometimes nitrate of soda or nitrate of potash, phosphoric acid as either superphosphate or guano phosphate and potash usually as nitrate; the dressings of artificial manures are given in two and sometimes in three applications. This represents an extremely rich manurial application.

2. In relation to virgin canes it has been shown by repeated experiments that when dressings of organic manures, i.e., *fumier* and molasses, are given, the addition of nitrogen as sulphate of ammonia usually is largely without effect, and the same applies very largely to phosphoric acid and potash. In cases, however, where natural manures in such liberal quantities are withheld, a profitable increase frequently occurs from the application of artificials, though even under these conditions the effect of nitrogen is often variable.

3. The advantage supposedly derived from applying artificial manures in two or more dressings is not borne out by experiments; more satisfactory results are obtained by making the application in one dressing fairly early in the canes' growth.

4. In relation to ratoons, the same holds true up to a certain point especially when dressings of organic manures are given.

5. Artificial manures applied in one crop do not as a rule show any residual action in the next succeeding crop under conditions encountered in Mauritius.

6. Molasses applications show a beneficial effect, provided the fertility of the land to which they are applied has not already reached the limit of productiveness to which it can be forced.

7. Ploughing is also capable of increasing the yield subject to the same reservation as under 6.

General conditions in relation to the sugar industry.— The continuation of low prices for sugar has resulted in the maintenance of the difficult conditions recorded in the previous year. These difficulties have been enhanced by the increased taxation necessitated by the loan of Rs. 5,000,000 distributed as an export bonus on the sugar of the 1926 crop. The outlook for the future of the market is obscure, but it is hoped that negotiations for the regulation of the output of sugar instituted by the Cuban Government, combined with the ordinary increase in the world's consumption of sugar, may soon lead to a more stable position.

As has repeatedly occurred in the past, the difficulties at present being experienced have led to considerably increased activity in relation to the sugar industry. In April, 1927, the first Sugar Industry Conference was held under the auspices and with the assistance of the Government, the president being Sir Henry Leclezio. At this Conference a number of questions relating to the sugar industry were discussed and important resolutions were carried: of these the most noteworthy had relation to the establishment of a Reserve Fund for the industry to be used for the purpose of effecting experiments and

improvements in factories and field, facilitating the visits of technical men from abroad and of local technical men and other planters to other countries, and financing the representation of the sugar industry in England. Legislative effect was given to the proposal by Ordinance No. 7 of 1927, whereby funds were provided by means of a special tax of 4 cents of a rupee per 100 kilos of sugar exported. The administration of the fund is placed into the hands of a Committee composed of nine members nominated by various public bodies connected with the sugar industry, under the presidency of the President of the Chamber of Agriculture. With the consent of the Government the Director of Agriculture was included among the members nominated. The subjects discussed comprised the type of sugar to be manufactured, methods of making payment for canes supplied to factories, and the extension of the research facilities of the industry. In this connexion the suggestion was made that assistance might be forthcoming from the Empire Marketing Board for the extension of research ; this proposal is now under discussion with the Secretary of State.

SUGAR CANE DISEASES.

The sectional Report on Sugar Cane Diseases states :—

Gummosis.—There are strong reasons to believe that Gummosis which was very widespread all over the Island has been the cause of the reduction in the crop of the year under review. The White Tanna which covers 56 per cent. of the total area under cane in the Colony was found to be highly infected with the disease. The prevalence of gummosis may be ascribed (1) to insufficient care in selecting planting material, (2) to a diminution in the degree of resistance of the White Tanna towards the disease, (3) to the atmospheric conditions which have been very favourable to the development of the disease. Gummosis was also detected on M 131, M 87, M 55/1182, M 55, Port Mackay and Louzier. The DK 74 was also found infected, though to a small extent, since this variety appears to offer considerable resistance towards that disease.

Smut caused by *Ustilago sacchari* was observed on ten estates all situated on the coast belt and in the drier parts of the Island : this disease is not responsible for serious losses, its importance during the period under review having been even less than during preceding years, on account of the wet atmospheric conditions which have prevailed during the first months of the growing season. The varieties affected were M 131, DK 74, RP 8, and M 55.

Red Rot caused by *Colletotrichum falcatum* was found commonly all over the Island where canes had suffered through the attacks of borers; a very severe outbreak of the disease on the DK 74 caused heavy losses on one estate. The investigations made have shown that outbreaks of that disease are generally subsequent to those of the moth borers of sugar cane and that in this country these insects are as a rule responsible for the outbreaks of that disease. The DK 74 shows little resistance towards the attack of the fungus.

Pineapple disease, caused by *Thielaviopsis paradoxa,* occasioned less damage than usual, as heavy rains during the planting seasons promoted rapid development of the buds and roots on the cuttings.

SUGAR TECHNOLOGICAL DIVISION.

The Sugar Technologist reports as follows :—

Cane selection.—The mass selection plot at Highlands was selected according to SHAMEL's method. Unfortunately, there were no particularly striking stools. A certain number amongst the best, however, were chosen and planted.

Visits to factories, Investigations.—Twenty-four factories were visited during the grinding season, many of them repeatedly and on special request. The defecation of the juice was easily performed in most factories all over the Island. Difficulties, however, were encountered in the same factory as last year. This is possibly due to a lack of phosphates in the juice. The glucose ratio of the juice was low on the average, and hence the molasses were not as well exhausted as usual,

The micro-organism isolated from the mucilaginous gummy substance clogging the filtering gauze of Peck strainers was studied. It is a short spore-forming bacillus, gram positive, with square-shaped ends growing on agar agar in large colonies with fluorescent edges. It turns ordinary bouillon turbid, forming on its surface a thick pellicle with fluorescent edges. It coagulates milk after two days at 37° C. It grows freely in beetroot juice, forming a thick viscous pellicle on the surface. This bacillus shows a great similitude with *Bacterium gelatinosum* described by GLASER.

For the first time, a double crusher has been installed in Mauritius. The tandem in question was formerly composed of one crusher and four mills. The results obtained were satisfactory, but would have been more so, if crushers of the Fulton type had been used. The Lafeuille crystallizers referred to in last year's report were reinstalled so as to avoid the mechanical difficulties of the first year's installations. The results obtained were good, but in both factories the drop in purity and the diminution of the relative proportion of massecuites were not as high as claimed by the inventors.

Water cooling devices were placed in open crystallizers in several factories with very satisfactory results, both with A and B massecuites. A sugar dryer was erected in a factory of the central plateau. It appears that the results obtained were not so good as expected, because of certain mechanical defects in its construction.

Investigations were carried out on the amount of sulphurous acid (SO_2) present in plantation white sugars manufactured during the 1926 crop. A method of direct titration was devised and after ascertaining that it gave reliable results, it was adopted. The conclusions arrived at were : I, that direct consumption sugar produced in the Colony contains less than the authorized maximum of 70 parts of SO_2 per million ; 2, that the proportion of SO_2 depends on the treatment of the syrup (*clairce*) : it decreases in factories where the syrup is subsided and is still lower where phosphoric acid is used for clarification.

Control Mutuel.—Thirty-three factories contributed to the " Controle Mutuel " and returns were regularly distributed fortnightly amongst contributors. A new feature is the publication of the names of nineteen of the factories with permission of the owners. This adds considerable interest to the " Controle Mutuel " and it is hoped that in future authorization will be given by all the factory owners to publish the names of their usines.

Educational.—A full course of lectures in sugar technology was delivered to the third year students of the College of Agriculture. Weekly lectures on Sugar House Chemistry and Chemical Control and on the cultivation of the sugar cane were delivered to the second year students. Practical demonstrations were given in the laboratory. Practical laboratory work was performed by students, after lectures, under the supervision of the Sugar Technologist. The second year students visited sugar factories in detail during the grinding season and followed the work of the factories ; the third year students visited in detail several factories during the off season with the Technologist.

The Outlook for the Indian Sugar Industry.

A Lecture by Sir James MacKenna, C.I.E.

On December 3rd last Sir JAMES MACKENNA, who was for many years Agricultural Adviser to the Government of India, and Director of the Agricultural Research Institute at Pusa, gave a lecture at the Royal Society of Arts on " The Indian Sugar Industry " and dealt with the many-sided problem of so improving its character and *modus operandi* that it would be able to face successfully the increasing competition of the outside sugar industry. We give here some of the principal points made in the paper, which can be found in full in the *Journal* of the Royal Society of Arts[1].

The lecturer began with a brief survey on the historical side, quoting NOEL DEERR and others on the origin of the cane and its probable botanical declension. The acreage of land under cane in India from 1890 to 1926 has remained at a fairly consistent level of between two and three million acres, the period of lowest cultivation being just before the war when cheap imports of foreign sugar were pouring into India. But it is apparent that while the population of India has increased enormously during the last three decades, the area under cane destined for gur or jaggery has only recently overtaken the acreage of the nineties ; meanwhile imports of foreign sugar have more than quadrupled. The inference would then appear to be that either the consumption of gur per head is falling off, or else a large number of people do not now use gur but consume imported refined sugar. Nevertheless, the annual consumption of gur is enormous, being, according to some figures of VENKATRAMAN, 75 per cent, of the whole ; the balance consists of 3 to 4 per cent. of home made crystal sugar, and 21 to 22 per cent. of imported sugar, chiefly from Java.

In view of this position it is clear that the claims of improved gur manufacture must figure prominently in any scheme for the betterment of the Indian sugar industry. For gur, if cleanly made, is wholesome appetising food, and is credited with containing certain vitamins which white sugar does not. Research work is, however, necessary to place this cottage industry on a proper and less wasteful basis, for it is improbable that it will ever entirely disappear from India. Hence any agency set up for the improvement of the Indian sugar industry will have to investigate thoroughly the problems of gur manufacture.

At one time India was actually a considerable exporter of sugar, the early records of the East India Company from 1609 onwards indicating a European enquiry for Indian sugar ; and the high water mark was probably reached in 1851 when great Britain took 75,307 tons of Indian sugar ; after that exports fell away, and of recent years the export trade has practically vanished, the 1926-27 figures being just over 2000 tons. Meantime imports have been steadily increasing, supplies pouring in from Egypt and China, Batavia and the Straits, and Mauritius. The culminating figures, those for 1926-27, amounted to no less than 826,900 tons, of which Java contributed 611,700 tons. The inevitable result of this has been a slow awakening to the fact that India must turn her attention to the improvement of her own refined sugar if she is to compete in this market at all.

This foreign competition has always caused a certain amount of anxiety in India and the general method of combating it has been by means of tariffs. Until the Mutiny the general rate of import duty was 5 per cent. ; following that struggle it was raised to 10 per cent. ; reduced to 7½ per cent. in 1864 ; to 5 per cent. again in 1875. In 1899 countervailing duties were introduced against bountied sugar, which had the immediate effect of diminishing imports

[1] Vol. LXXVII, No. 3970, December 21st, 1928.

of German and Austrian sugar. But their places were promptly taken by sugars from Mauritius, Java and the East, which increased by more than 40 per cent. The countervailing duties generally were discontinued in 1903, following on the Brussels Convention, and sugar was then subject only to the ordinary 5 per cent. tax on all imports. After the war the duty was raised to 10 per cent. in 1916, to 15 per cent. *ad valorem* in 1921, and to 25 per cent. *ad valorem* in 1922. In 1925 it was converted into the present specific duty of 4½ rupees per cwt. of sugar 23 D.S. and above, and 4 rupees on sugar from 8 to 22 D.S. Sugar below 8 D.S. is subject to 25 per cent. *ad valorem* duty.

There is a tendency in certain quarters to demand yet higher duties. But Sir JAMES MACKENNA takes the line that the limit of protection by tariffs has been reached and that further assistance would be unjustifiable. The protective policy has certainly acted as an encouragement to Indian sugar manufacture, and has probably saved the industry from complete extinction. But any amelioration of the position must be looked for in other directions, and the lecturer devoted a good deal of his paper to indicating what in his view these might be.

He outlined the work of the Departments of Agriculture since these were re-organized in 1905. At a meeting of the Board of Agriculture in Cawnpore in 1907, a scheme suggested by Dr. BARBER, then Government Botanist of Madras, for an official enquiry into the Indian sugar industry was put forward. The immediate result was a recommendation of the Board to local governments to establish central factories and sugar cane experimental stations. Unfortunately the local governments took little or no action in the matter. In 1911 the Board of Agriculture took up the question once more and passed a number of resolutions, two of which were that (1) the sugar industry deserved the assistance of the Government and (2) an acclimatization and cane-breeding station should be established in Madras. The Government of India then took action. A sugar engineer was appointed by them to work under the Government of the United Provinces. A small government factory was erected at Nawabganj, designed to turn out 1½ tons of sugar per day of 24 hours. It was a five-roller mill and the equipment differed little from that of the modern factory except for the omission of an intermediate vacuum evaporator. The factory, as far as efficiency of the mill was concerned, was a success, but the experiment failed because the evaporating capacity was not equal to the crushing power, while the factory experienced great difficulty in securing adequate supplies of cane. The experiment demonstrated that the direct manufacture of white sugar in small factories with open pan boiling is unlikely to succeed on account of the high cost of production, heavy loss of crystalline sugar, and unduly high proportion of molasses.

The resolution relating to the cane-breeding station was destined to bear much greater fruit. The Coimbatore station was started and Dr. BARBER placed in charge for a period of five years. He entered on his duties in 1912 and retired in 1919. Sir JAMES MACKENNA declared that it was impossible to over-estimate the work which BARBER did for the sugar cane industry of India during his appointment, and it was safe to say that if his work was continued along the lines laid down by him, and under competent supervision the thin cane problem of India would be solved. The work has now been made a permanent feature and is under the Government of India. A second officer has been recruited to do breeding work on thick canes.

The Coimbatore station has already more than justified its existence by the evolution of new cross bred canes, some of which, notably Coimbatore

205, 210, 213, 214, are now grown in extensive areas of the Punjab, United Provinces, Bihar, and Bengal. In the Western circle of the United Provinces the area under these canes is some 40,000 acres, while in Northern Bihar it is over 12,000 acres. Not only do the canes give a higher yield, but they have the further advantage that they do not demand a standard of cultivation and manuring which is beyond the power of the cultivators in these parts to give them. The introduction of these Coimbatore seedlings in the white sugar tracts of Northern India has completely revolutionized the position so far as the white sugar industry is concerned, and upon their further spread depends largely the extension of sugar refineries in Northern India. As regards the gur industry, however, the value of the improved canes which are being introduced will be very largely diminished if improved methods of crushing and boiling do not go hand in hand with the increased yield. At present Coimbatore canes are being distributed fairly rapidly and widely, but a really efficient mill to deal with them has not yet been discovered. Until the manufacturing side of the country sugar industry is made efficient, the increased cane yields will merely increase the waste, and the benefit to the cane grower will be largely lost.

As regards the thick canes, much valuable work has been done by Mr. GEORGE CLARKE at Shajahanpur, by successfully introducing exotic varieties and by careful attention to all agricultural processes involved in their cultivation. Very large tracts in the United Provinces are now under these improved selected canes.

The improvement of the faulty methods of dealing with the cane will first be reflected in the improvement of the *gur* and *rab* industry. But to check imports of foreign sugar, the establishment of modern efficient factories is the only way to solve the problem. India at present is not making the fullest use of her raw material; the waste that is going on is simply colossal. The acreage under cane last year was 3,071,000 acres and if we deduct 16 per cent. as providing cane for chewing, sets for planting, and for cattle fodder, we are left with 2,580,000 acres. Out of this, roughly, only 80,000 acres provide cane for the manufacture of sugar in modern factories. The produce of the remaining area is converted into *gur* or *raw* sugar. As Mr. NOEL DEERR has pointed out, India at present makes 2½ million tons of gur from a like number of acres (averaging 10 tons cane per acre, and 10 maunds gur from 100 maunds of cane); if the produce from these 2½ million acres were converted into sugar in an efficient modern factory, the monetary returns would be about double. No other country in the world could stand such huge waste of available material. But there are at present only 40 sugar factories with a combined output of hardly 100,000 tons.

A further stage was reached in 1919 when the Indian Sugar Producers' Association urged that the time had arrived to take steps to improve and develop the Indian sugar industry; and an "Indian Sugar Committee" was appointed to go thoroughly into the whole question. This body recommended, *inter alia*, the formation of a Sugar Board, the creation of a Sugar Research Institute, a pioneer model sugar factory, and a Sugar School. Unfortunately these recommendations have not yet been given effect to, and the main problems remain to be tackled.

There is no need to increase the present area under cane or to infringe on areas at present utilized for other food crops. Already the area is nearly double what it need be if the sugar industry were efficiently conducted. It is not, it is true, in most cases possible to obtain factory control of land, and cane will frequently have to be collected from small and scattered holdings,

but it is not a matter of great difficulty for a factory to work up a connexion with local cultivators for regular supplies, and the latter are not likely to show unwillingness to take up better cane varieties.

Sir James MacKenna summed up his suggestions for the betterment of the industry as follows :—

" (1) That the work of the cane-breeding station at Coimbatore should be continued and extended and that arrangements should be made to ensure continuity. Dr. Barber has gone and Rao Bahadur Venkatraman cannot go on for ever. A thoroughly competent botanist should be in training to carry on the work when a vacancy occurs.

" (2) In Provinces in which sugar cane is of importance one deputy director of agriculture should be recognized as the provincial sugar cane expert, and so far as possible his labours should be limited to the one crop. It will be his duty (*a*) to study the local canes and select the best of them ; (*b*) to make such arrangements as may be necessary for the careful testing of his own selected canes and of the Coimbatore canes, and for the multiplication and distribution of such improved canes as may be recommended.

" (3) While work in the Provinces must naturally be entirely under Provincial control, arrangements should be made for the closest collaboration between the Imperial sugar expert and Provincial officers working on sugar cane. The Central Board of Agricultural Research should be in a position to arrange the necessary links between Imperial and Provincial officers. It is of vital importance that there should be the closest relations between Coimbatore and Provincial officers and exchange of visits between them should be encouraged. No obstacles should be placed in the way of the Imperial sugar cane expert, and he should be encouraged to travel freely over India in order to keep in touch with the developments in the Provinces and to observe the behaviour of his selected seedlings under varying conditions which will be found up and down India. I emphasize that to ensure success of the Coimbatore work and to guarantee its spreading all over tracts of India where Coimbatore canes are found to succeed, there must be the closest collaboration between the sugar cane expert and Provincial workers. All petty jealousies must be sunk and all must work with common aim.

" (4) Where composite blocks of suitable land are available and where there are no local difficulties, large grants of waste land suitable for the cultivation of sugar cane should be given to groups or individuals who are prepared to erect a modern sugar factory. We cannot get away from the fact that the great factor in Java's success is that factories have control of the land and are both growers of the cane and manufacturers of sugar. Where, therefore, a similar position could be developed in India without interfering with the general interest of the community, the Government should have no hesitation in granting land on favourable terms to manufacturers who are prepared both to grow and manufacture sugar.

" (5) It will be for the Council of Agricultural Research to decide whether a central Sugar Research Institute is required and whether the Government should set up an experimental sugar factory. Personally, I do not think that the latter is necessary, but the former might be the best and cheapest way of working out problems of general application connected with crushing, small power installations, fuel consumption, and the like, and also the innumerable problems connected with *gur* manufacture.

" (6) It will also be for the Council of Agricultural Research to decide whether the Sugar Bureau should be made permanent, and, if so, on what lines it should continue to work.

"(7) Agricultural problems connected with sugar cane must be worked out locally in the Provinces, but a mycologist might be attached to the Coimbatore station, whose personal concern would be investigation of the diseases of sugar cane and whose services would be at the disposal of all Provinces. The Java industry was saved from complete ruin in 1884 by concerted scientific attack on the *Sereh* disease, which threatened to exterminate it. A similar calamity may strike India at any moment, and we must be prepared to meet such a possibility."

In the discussion that followed the reading of this paper, Dr. C. A. BARBER. C.I.E., said that the origin of the sugar cane was a subject that interested him greatly and he would like to say one or two words on that point. Originally he had thought, as most others had done, that the sugar cane was probably derived from the wild cane, *S. spontaneum*, but the problem of finding transitional stages had got more and more difficult, until finally he had had to give it up. The present general view was that the cultivated sugar cane had to be divided into two entirely separate classes of different origins. That was a recent view now generally accepted by students. North Indian canes were very different from tropical ones ; they were thin and hardy, had much fibre and little juice, although the sugar was sometimes very good. It was now generally assumed that these had arisen in India itself around the northern shore of the Bay of Bengal. It was almost impossible to conceive of the tropical sugar cane having originated in India ; the general view now was that it had arisen from an entirely separate form in the islands of Oceania and especially New Guinea. He had always thought New Guinea was the place to look for them, and he put forward the view that there was no possible means of Indian influence reaching the interior of that island.

Touching on costs of production, Dr. BARBER compared the respective costs of labour in several countries : Labour was 17s. per day in Queensland, 5s. in Cuba, 10d. in Java, and about 4d. to 8d. per day in India. Yet Java produced its cane at about £7 to £8 per ton, while in India it cost from £11 to £15. Labour, then, was not the only key to the situation. One other was the comparative size of the factories, which in India were extremely small. The factor, however, with which he was most concerned was the cane types used ; and in this connexion he quoted what had been done in Java to improve output from a given area. In 1912-13 Java with some 450,000 acres produced about 1,300,000 tons of sugar. In 1919-20 the figure was 1,500,000 tons of sugar, in 1923-24, 1,700,000 tons, in 1925-26, 2,300,000 tons and in 1927-28, 2,900,000 tons, while next year it would probably be 3,200,000 tons—all these crops from virtually the same acreage as in 1912-13. The chief factor in this big increase was obviously the new kinds of cane that were planted. A number of these improved Java seedlings were developed in the period from 1912 to 1924. Then from 1926 to the present day the marked increase was due to the evolution of the new POJ 2878 which was displacing all the others and next year was expected to fill nearly the whole of Java. This, surely, was a very strong argument in favour of pushing cane breeding to its extreme limits, so long as it was properly done.

Dr. BARBER sends us the following additional information on cane types, which he had intended to give to the meeting, but was by chance unable to do. It shows certain interesting common points in the parentage of the new Java seedling and that of one of the Coimbatore varieties, which will doubtless merit the attention of cane plant breeders :—

The Outlook for the Indian Sugar Industry.

"In connexion with the rapid spread of POJ 2878 in Java—a country which everyone thought to be very well provided with excellent canes—and the much less important or spectacular increase in acreage under the Coimbatore seedlings in India, the following facts may be of interest.

"Co 205, one of the seedlings which has done very well in the Punjab and now appears to be awakening interest in the Bihar region at the opposite end of the Indo-Gangetic plain, is a direct cross between a thick tropical cane and the wild grass *Saccharum spontaneum*. And in tracing the parentage of POJ 2878, we find that one of its grandparents is a so-called wild cane in Java, Kassoer; and all the evidence appears to point to the fact that this has arisen in nature as a cross between Black Cheribon and Glagah, the local *Saccharum spontaneum*. Co 205 and POJ 2878 are thus blood relations, in western parlance being respectively a "mulatto" and an "octoroon"; and it is interesting to enquire what is their chief character in common.

"Co 205 owes its value to the fact that it is strongly drought-resistant and yet can grow to maturity in standing water, arguing a wonderfully adaptable root system. And POJ 2878 appears to suit all the different Java tracts, hitherto carefully apportioned to different cane varieties, again suggesting a very adaptable root system. *Saccharum spontaneum* is alike at home as a pestiferous weed in the dry wheat fields of the Punjab, and in water-logged ditches all over India."

Steam Accumulators.[1]

By J. LEWIS RENTON.

A steam accumulator is a piece of apparatus which stores the heat energy of steam in water at saturation pressure and temperature, and releases this energy in the form of steam under decreasing pressure. It, therefore, follows that the plant load may fluctuate between wide limits without necessitating any change in the firing of the boilers to maintain uniform steam pressure. There are two types of accumulators now, which may be designated as the high pressure flash type and the large capacity storage type.

The high pressure flash type accumulator would probably not be applicable to sugar-house work and will be only briefly described here. This accumulator was designed to flatten out the sudden and intermittent demands for steam upon the boilers by the operation of steam hammers, hoisting engines, rolling-mill engines, and such equipment. As the name implies, the flash-type accumulator must supply large quantities of steam over a very short period of time, and also be capable of condensing and storing a large quantity of steam in an equally short period of time. Being of the high pressure type it must necessarily be compact to have the required strength. These flash-type high pressure accumulators are usually vertical cylindrical vessels entirely filled with shallow trays, the trays being attached to a perforated centre supply pipe. In *Power* (June 5th, 1928), an accumulator of this type is described which is fed through a throttle valve at the rate of 30,000 lbs. of steam per hour, the boilers being kept at 200 lbs. gauge pressure. During the 12 seconds that there was a demand for steam, pressure on the accumulator dropped from 200 to 175 lbs., and the accumulator liberated at the rate of 30,000 lbs. of steam per hour, and, with the boilers. supplied steam at the rate of 60,000 lbs. per hour to a hoisting engine. During the next 12 seconds

[1] A Paper read at the 1928 Meeting of the Association of Hawaiian Sugar Technologists.

the engine was shut down and the accumulator was recharged, the boiler pressure remaining constant all the time at 200 lbs. gauge pressure.

The large capacity storage type steam accumulator has found wide application in the industries in Europe (over 300 having been installed) and is now beginning to receive the attention it deserves in America. This type, of which the "Ruths Steam Accumulator" is probably the best known, differs from the flash-type in that the storage capacity is larger and the cycle is not so

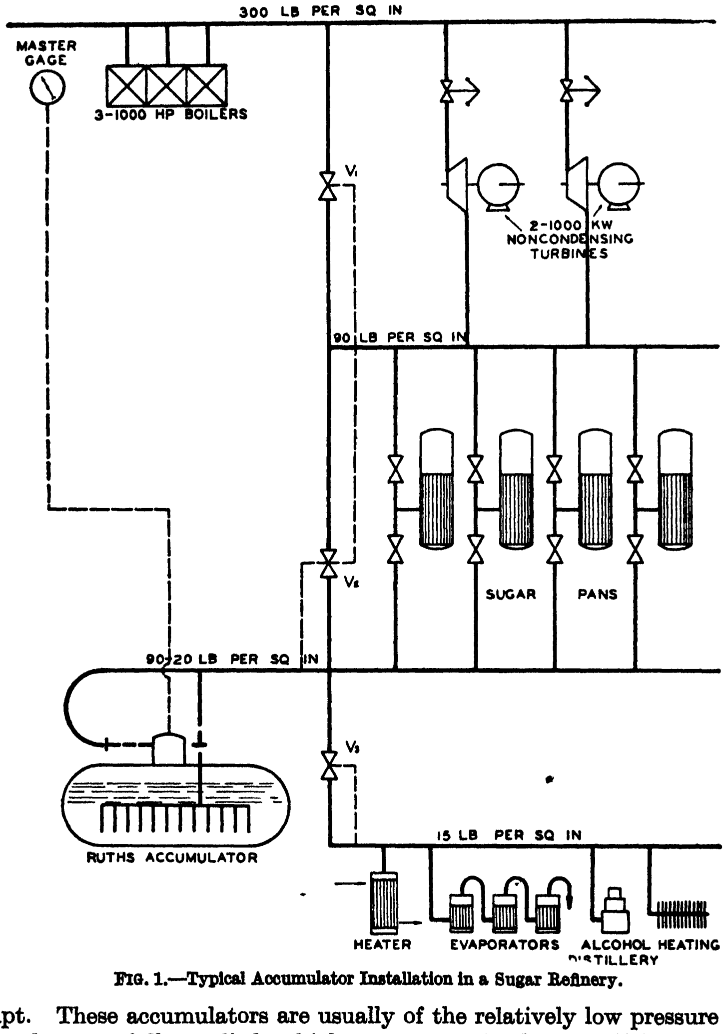


FIG. 1.—Typical Accumulator Installation in a Sugar Refinery.

abrupt. These accumulators are usually of the relatively low pressure type, although successfully applied to high pressure work where conditions warrant.

The Ruths Steam Accumulator has passed the experimental stage and as now designed is entirely automatic in its operation. It is supported on four legs, only one of which is fixed, the other three being free enough to allow for any expansion or contraction that may occur. Steam is admitted to the accumulator through many nozzles which are placed within tubes in such a manner that the heating is noiseless, and a rapid circulation is set up within

the body which results in a uniform temperature throughout the body. This circulation effect aids in storing heat, as it brings the entire body of water in contact with the steam; whereas, if steam was admitted only to the surface of the hot water, the surface would be heated to a higher temperature, but it would take quite a time before the heat was dissipated throughout the mass.

The outlet nozzle in the dome is of such a design that it limits the maximum discharge rate of the accumulator, thus preventing priming. Check valves placed in the steam lines to and from the accumulator (see Figure 1) confine the flow of steam to the nozzles and from the dome as conditions demand.

The body is covered with four inches of insulating material, and the radiation is about 0·2 B.T.U. per square foot per hour per degree difference in temperature.

Figure 1 shows a typical Accumulator installation in a sugar refinery. Valves V_1, V_2, and V_3 are the oil-operated automatic controlling or reducing valves. The operation of the accumulator installation shown in Figure 1 is briefly as follows :—Valve V_1 will maintain 300 lbs. steam pressure on the boilers by automatically passing to the 90-lb. pressure main any steam in excess of the turbine requirements which would tend to raise the boiler pressure above 300 lbs. pressure. Valve V_2, in turn, will automatically pass on to the accumulator any steam in excess of the vacuum pan requirements, assuming the vacuum pans to be using the 90-lb. pressure steam. Valve V. automatically maintains the low pressure lines at 15 lbs. pressure.

The accumulator will fluctuate between 90 and 20 lbs. pressure, depending upon the steam requirements of the plant. The master gauge in the fire room will indicate the conditions prevailing throughout the factory at all times. If the accumulator becomes discharged, the valves V_1, V_2 and V_3 will automatically draw on the reserve in the boilers themselves and reduce the boiler pressure until this condition has been overcome. Conversely, if the accumulator becomes fully charged and more steam is produced than the plant requires, the excess will not be passed on to the 90-lb. line through V_1, but the pressure on the boilers will rise until the safety valves pop or the condition is overcome.

What naturally interests us is, whether or not a steam accumulator is adaptable to our particular factory, and if so, how would it pay for itself? Wherever steam is used intermittently, as in vacuum pan work, there is a field for a steam accumulator. No matter what system you put into effect to overlap or stagger your pan cycles, you are bound to have a variable steam demand. The raw sugar pans have a shorter cycle than the low grade pans, and the different stages of boiling (as starting up and boiling down) require varying quantities of steam. In designing a new factory, or remodelling an existing factory, this piece of equipment should be carefully considered. A steam accumulator cannot store up or release steam or heat units unless there is a fluctuation of pressure. In other words, an accumulator would not function economically floating on a back pressure or exhaust line that only varied two or three lbs. Those factories that employ reducing valves to maintain a constant back pressure for vacuum pan work present, probably, the most fertile field for investigation along these lines.

The advantages claimed for the Ruths Steam Accumulator are :—
(*a*) It reduces fuel consumption ; (*b*) reduces boiler maintenance ; (*c*) simplifies boiler control ; (*d*)) maintains constant steam pressure ; (*e*) maintains uniform quality of product ; (*f*) increases production ; (*g*) reduces initial cost of new boiler installation ; and (*h*) increases steam generating capacity.

(*a*) Most of the Hawaiian factories are blessed with sufficient bagasse, and are not particularly interested in saving fuel. It is only those factories that do not have sufficient bagasse, or who supply large quantities of outside power in the form of electrical energy that could profit by a fuel saving. The fuel saving comes from operating a definite number of boilers at a fixed rating.

(*b*) Reduced boiler maintenance is claimed, due to the fact that with a steady boiler load the boilers and brickwork are kept at a uniform temperature, which results in a minimum of upkeep.

(*c*) Simplified boiler control results from a steady uniform load.

(*d*) The many accumulator installations have proved that with the proper size accumulator a steady boiler pressure as well as steady low pressure is maintained. Figure 2 (from installation shown in Figure 1) shows the fluctuating accumulator pressure with uniform low pressure output.

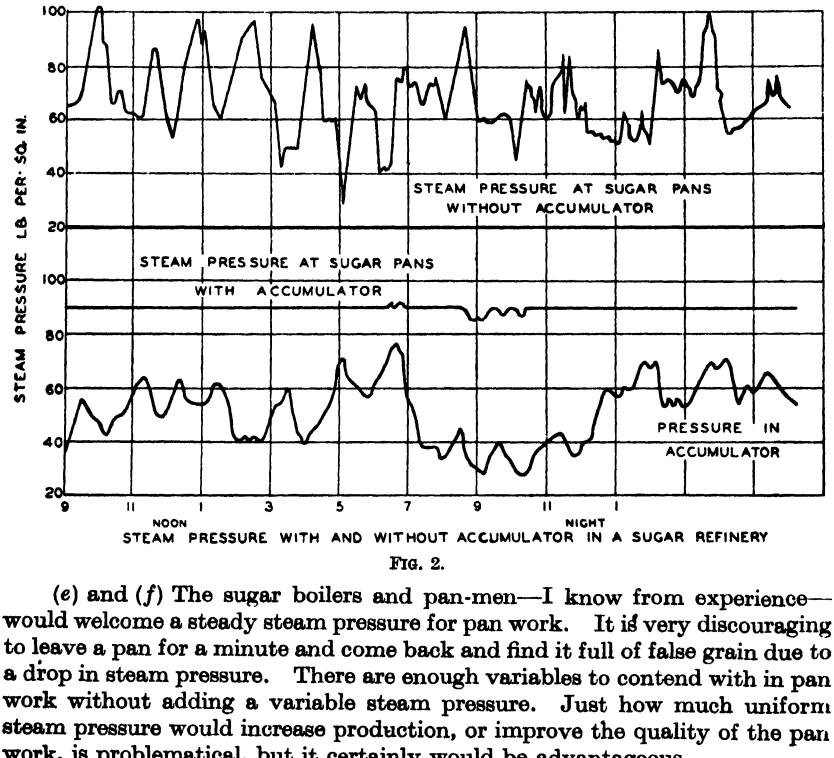


FIG. 2.

(*e*) and (*f*) The sugar boilers and pan-men—I know from experience—would welcome a steady steam pressure for pan work. It is very discouraging to leave a pan for a minute and come back and find it full of false grain due to a drop in steam pressure. There are enough variables to contend with in pan work without adding a variable steam pressure. Just how much uniform steam pressure would increase production, or improve the quality of the pan work, is problematical, but it certainly would be advantageous.

(*g*) and (*h*) I believe it is in this field, of increasing the steam-generating capacity of the boiler plant, or reducing the initial cost of new boiler installations, that the most direct gain in dollars can be computed in favour of an accumulator in our Hawaiian sugar factories. It is hard to visualize why it should take more boilers to furnish a given quantity of steam under fluctuating steam-pressure conditions without an accumulator than under uniform steam pressure conditions with one. It works out in practice that enough boilers must be kept on the line to furnish steam at the *maximum* demand rate, and that this number is more than necessary for average conditions.

Just why an accumulator can bridge over this maximum demand period is easily understood by a study of the curves on chart Figure 3. Let us

assume that the accumulator is of such a size that its water content is equal to the combined water content of all the boilers in series. If the boilers are run at 120 lbs. pressure and are pulled down to 100 lbs. pressure by excessive steam demand, each cubic foot of water in the boilers would liberate 0·75 lbs. of steam per cubic foot of water contained. If the accumulator in the above case was run at 80 lbs. pressure and supplying steam to a 20-lb. back-pressure line for boiling, in dropping from 80 to 20 lbs. the accumulator would liberate 4 lbs. of steam per cubic foot of water content, or 5·33 times as much steam as the boilers, without affecting the boiler pressure at all. It is this feature of the accumulator that enables an accumulator installation to successfully bridge over the periods of maximum steam demand without lowering the boiler pressure. Usually such a drop in boiler pressure as out-

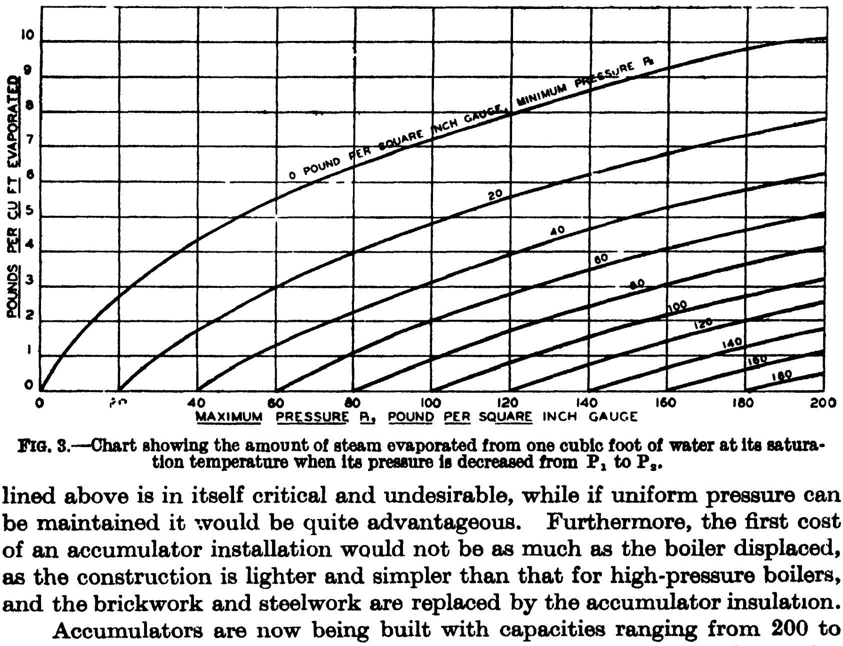


FIG. 3.—Chart showing the amount of steam evaporated from one cubic foot of water at its saturation temperature when its pressure is decreased from P_1 to P_2.

lined above is in itself critical and undesirable, while if uniform pressure can be maintained it would be quite advantageous. Furthermore, the first cost of an accumulator installation would not be as much as the boiler displaced, as the construction is lighter and simpler than that for high-pressure boilers, and the brickwork and steelwork are replaced by the accumulator insulation.

Accumulators are now being built with capacities ranging from 200 to 13,000 cub. ft. capacity each, and installations with as high a total capacity as 37,000 cub. ft. have been erected. But since no two factories are alike as to raw material, equipment, and outside demands, it would be foolish to state that an accumulator installation would pay for itself, without first making a detailed study of the whole situation and basing the results on cold facts rather than on desirability.

Glycerin is now being produced from beet molasses in Czecho-slovakia by a fermentation process similar to the " Protol " method used in Germany during the war.

Attention is directed to the three courses of Lectures commencing January 11th at the City of London College on subjects connected with the Sugar Trade. Section I deals with the " Economic Geography and Statistics of Sugar," by Mr. C. J. Robertson, M.A., B.Sc.; Section II with the " Scientific Study of Sugar," by Mr. S. J. Duly, M.A.; and Section III with the " Marketing of Sugar," by Mr. Wm. O'Toole, whose name is well known as Secretary of the Sugar Association of London and of the United Terminal Sugar Market Association. These are excellent courses, and should be well appreciated.

The Maxwell Crusher-Shredder.

Java Experiment Station Report on its Working.

A report of the Java Sugar Experiment Station, on the Maxwell Crusher-Shredder, dated September 5th, 1928, addressed to the firm Coster van Voorhout & Co., of Sourabaya, was recently published. It stated that in August last the engineer attached to the Technical Department of the Station visited the Poppah factory with the purpose of testing the accuracy of figures which had been obtained representing the undiluted juice lost per cent. fibre, i.e., 42 to 44 which had been obtained.

The investigation purported to verify the guarantee of Dr. Francis Maxwell in connexion with the conversion of the Krajewski crusher into a Maxwell Crusher-Shredder, viz., that the Poppah Factory would achieve with its milling train of a Crusher-Shredder, 30 in. × 60 in., and three mills, 32 in. × 72 in., at a crushing capacity of 1110 tons daily, the same result as obtained on an average by its sister factory, Watoetoelis, for the seasons 1926 and 1927 with a crusher and four mills.

At Watoetoelis the figures for the undiluted juice lost per cent. fibre for the two seasons named were 40·3 and 37·96, so that the milling train at Poppah had to produce a figure of 39·13. At the outset, the report discussed the factors conducing to a correct figure for the undiluted juice lost per cent. fibre, and the precautions taken to ensure the accuracy of the result. Official methods of sampling and analysis of the Experiment Station were followed, and the figures obtained were tabulated. From this tabulation the "juice lost" figures as determined on August 23rd and 24th were calculated to be: 36·17 and 39·51, and the following conclusion is stated :—

"The average lost juice per cent. fibre as determined by our tests does not lend itself, owing to the short period in which the tests were carried out, to a completely accurate comparison with the average of preceding periods. Nevertheless, we consider that these figures afford sufficient indication as to the level in the vicinity of which the lost juice per cent. fibre will move in the next periods . . . . . . Considering thus the greater quantity of imbibition water used in respect to the previous seasons, 1926 and 1927, 40-50 per cent. fibre more as well as that the imbibition of second mill juice before the mill is inherent to the application of a Maxwell Crusher-Shredder, *it is our opinion that the final results obtained during both tests certainly proved that the guarantee given by Dr. Maxwell has been fulfilled.*"

Shortly after this the Report goes on to say that: "*Taking into account the comparatively small costs of the Maxwell Shredder, we are convinced that its adoption is profitable, and that the gain in juice extracted is approximately equal to that from an additional mill.* For an additional mill as an average is assumed a decrease of about 11 parts of juice lost per cent. fibre when a mill is added to a train of a crusher and three mills, and about eight parts in the case of a crusher and four mills."

"From the point of view of construction there need be no objection to its adoption. The important point lies in the bearings . . . . but the results from the roller bearings adopted at Poppah are so good that this question may be considered as solved. When further, as experience leads us to expect, one set of knives (price at present, £150) suffices for one season, then these costs and the trouble of turning the knives once or more times are of a minor nature."

At the end of the official report, the following "relevant information" is appended: At Poppah the Maxwell Shredder was fitted on the Krajewski crusher, co-acting with top and bottom rollers, thereby converting the latter

into a Maxwell Crusher-Shredder. In the form of a mill-shredder the Maxwell Shredder is best applied as an additional roller (not as a substitute) above the discharge roller, and close to the top roller of the first mill, thereby converting it into a Maxwell 4-roller Mill-Shredder. Any existing crusher can be readily and cheaply converted into a Maxwell Crusher-Shredder by simply using new headstocks, the same holding good in the conversion of any existing mill into a Maxwell 4-roller Mill-Shredder. The conclusion appearing in the above report may be conveniently boiled down to the formula : *Maxwell Shredder Roller equals One Mill.*

Recent Work in Sugar Cane Agriculture.[1]

Annual Report of the Department of Agriculture, Uganda Protectorate, 1927.

The exports from Uganda during this year were : Cotton valued at close on £2,000,000, Coffee £170,000, Rubber £82,000, Sugar (chiefly refined) £16,800, Simsim (oilseeds) £14,000, as the chief vegetable productions, but this by no means indicates the relative value of the crops grown. The sugar factory, established in 1925 at Lugaze to the north west of Lake Victoria Nyanza, is now fully equipped and capable of producing 4000 tons of refined sugar a year, and is being increased for a 5000-ton output. A local market exists in Uganda and Kenya for the whole of this amount of sugar. A distillery has now been erected, which produces large quantities of power alcohol for local uses, and 638 gallons of methylated spirit were also exported.

The varieties of cane grown are given as (1) Soft yellow ones such as B 3922, Sealey's Seedling and certain unidentified Ceylon ones, and (2) Striped Ribbon, Striped Bamboo and Tanna varieties ; but the former have been found to be liable to an obscure " top-rot," and are giving place to the latter which are more resistant. Mosaic has made its appearance on one estate only, where the evidence points to its entry in 1926, as all earlier plantings are free and no canes have been introduced from outside for several years. It is hoped that the disease will be kept under control ; the introduction of Uba is not desired because of the cost of changing the varieties and modifications in the factory, and the POJ varieties already obtained are being multiplied as fast as possible. During the year a number of varieties have also been received from the West Indies, which represent a great advance on the kinds hitherto grown in Uganda.

The area under sugar cane in Uganda is given as follows : native fields 3205 acres, Indian 3685 plant canes and 1420 ratoons, and European 260. These statements indicate the present position of the sugar industry in Uganda, and the reader is referred to *I.S.J.* 1925, pp. 403-404 and 436-437, for further information on the subject.

Deuxième Rapport de la Station Agronomique de la Guadeloupe, 1927-1928. **C. H. Williams.** Director.

An English version of the text of the Report is provided, together with a map, including Guadeloupe proper, Grande Terre and Marie-Galante, in which the ranges of mountains are sketched. Any possible criticisms are disarmed by the Director in a statement of the extraordinary series of changes in staff from Director downwards during the last three years ; it will obviously

[1] Owing to the large number of papers which have accumulated during the past few months, references will have to be comparatively short; but it is hoped that an opportunity will occur for dealing with some of them more fully at a future date.

be some time before the experimental work will provide reliable data on which to base advice to the planters. The 1927-28 crop was expected to be an increase on the previous year (although this does not appear to be the case from figures presented elsewhere) because of the great growth of canes, owing to good rains, extension of good varieties, more manure and greater care in cultivation, but the mill work was acknowledged to be very far from what it should be.

The island, it is claimed, is free from the diseases so common in cane fields, and the only enemy is the moth borer. This freedom is put down to the strict regulations against the import of canes from outside since 1922. All the same, evasion has been proved by the appearance of two new kinds of cane within a year ; and the author of the report urges the necessity of adequate quarantine arrangements, so that good new kinds may be introduced through the proper channels. Under these conditions, the question of varieties is somewhat important. From the context, Ribbon and White Tanna appear to be standard canes, but Ba 11569 and S.C. 12 (4) are rapidly spreading. On comparing local seedlings with these there would appear to be no doubt that Guadeloupe has succeeded in her seedling work. One seedling, G 119, in fact has had such a universal triumph that the advice is given to multiply it as fast as possible, in the hope that it will soon replace all the standard canes. Its resistance to disease, it may be remarked, has of course not been as yet tested ; but the figures presented leave no doubt in the matter, even allowing for the admitted unreliability of the experimental work. Many of the estate experimental plots were left out of consideration because of inattention to weeding and elementary cultivation practices. There is thus a great deal of interesting work to be expected, when the difficulties which the new Director so plainly points out in his report have been overcome.

THE TECHNIQUE OF CANE FERTILIZER EXPERIMENTS. **C. Holman. B. Williams,** Director of the Station Agronomique de la Guadeloupe. *Facts about Sugar*, September 15th, 1928.

The value of this paper lies not so much in the arrangement of the plots to minimize error, about which so much has been written of late, as in the simple orderly means which are adopted that the whole routine, from the weighing out of the manure and the dosing of the clump, to the cutting and weighing of the canes at harvest, may proceed with the least possibility of errors creeping in. No system is of course fool proof and the author points to the places where error is most to be feared, and the way in which to avoid it. When the individual clump is taken as the unit, as in this case, it will be obvious that a well thought out scheme of operations is necessary; and that presented by the author might be taken as a guide unless local conditions of staff and labour prevent it. " Working as described above, with six carriers (women), three diggers (boys), one woman at the base for handling fertilizer to the weighing assistants, three assistants for weighing, one for supervising the application, and an officer in general charge of the operations, checking weights, seeing that the correct mixture is employed, etc., we complete four plots (of 20 clumps each) per hour."

COMPILATION OF COMMITTEE REPORTS FOR THE SIXTH ANNUAL CONVENTION OF THE PHILIPPINE SUGAR ASSOCIATION, 1928.

The procedure followed at this Convention appears to have been similar to that adopted in the Hawaiian Sugar Planters Association, which may in a sense be considered as the parent body. The issues in the Philippines are, naturally, less complex, both because of the smallness of the staff and the state

of the industry ; and yet the variations in all directions are probably considerably greater than in Hawaii. It is impossible in the present notice to do more than give some indication of the problems at present being attacked.

The annual report of the Secretary-Treasurer, by G. H. FAIRCHILD, whose name and work are sufficiently well known, deals chiefly with the general conditions of the industry and the finances of the Association. On the plantation side, the most interesting paragraphs are those dealing with the steps being taken to acquire a suitable experiment station, legislation proposed to facilitate the reclamation of low-lying areas in the sugar districts, and the development of hydro-electric power for the production of nitrogenous fertilizer from the air.

This report is followed by that of the new Director of Experiments, H. A. LEE, who commences with the enumeration of the small staff at his disposal : M. L. ROXAS, Director of experimental work in Luzon, M. G. MEDALLA, in charge of experimental work in Negros, and C. T. BULIGAN, Assistant Entomologist. In addition he has the co-operation of N. B. MENDIOLA, Agronomist and Cane breeder, and of L. B. UICHANCO, Entomologist in the College of Agriculture of the Philippines. The Association has also a numerous and efficient body of field assistants. These are furnished by each Central and Planters' Association, affording a means of contact between the planters and the Centrals and in both cases with the Philippine Sugar Association ; and an important part of their work is the keeping of records in all directions, thus representing in some sort the group advisers in Java. The work forecasted for the year is classed under Cane varieties, Fertilizer experiments, Abo-abo soils (highly acid, loose, black, sandy) in Western Negros, Liming the soil, Root studies, Cane diseases and pests, and Experiment stations. Then follows a long Report by M. L. ROXAS, covering very wide ground and giving details of work being done in Luzon and its future requirements ; and this is succeeded by the report of L. B. UICHANCO, on entomological matters.

As is usual in these publications, these official reports are supplemented by numerous letters and papers by planters and others who have made special studies of particular aspects of the industry in the Philippines. These papers are printed in larger type, and are classed under two main headings—Cane Cultivation and Animal Husbandry (pp. 27-50), and Cane Varieties, Diseases and Fertilizers, (printed separately and covering 128 pages).

REPORT OF THE COLLEGE OF AGRICULTURE, MAURITIUS, FOR THE YEAR 1927.

During the year the course of studies underwent considerable alteration, and the College year was changed so as to commence in April instead of January as formerly. The complete course for the diploma is to comprise nine terms and will finish in March. The first year will be devoted entirely to the sciences underlying agricultural practice ; and follow in general outline the syllabus for the Intermediate examination in Agriculture in London University ; arrangements have been made to hold this examination in Mauritius. Combining the three years of instruction, there are 31 students on the books, an increase of five over the preceding year.

The regulations as to the "laureateships" and scholarships have also been entirely recast during the year. The former is a travelling scholarship awarded each year, and the work of three of these scholars is referred to. R. AVICE completed his course of studies at the Royal Technical College, Glasgow, and at the workshops of Mirrlees Watson Co. He obtained the diploma of the Royal Technical College in June, 1927, and returned to the

Colony at the end of the year as Assistant Sugar Technologist. D. BAPTISTE continues his studies in Plant Pathology at the Imperial College of Science and Technology, London. This year the laureateship was awarded to R. OLIVIER who will proceed to Reading University to study Agricultural Chemistry.

THE SUGAR CANE MOTH STALKBORER. **D. L. van Dine.** *Tropical Plant Research Foundation. Bulletin* 2. 1926.

This paper gives a short semi-popular account of this outstanding pest in the sugar cane fields, and draws attention especially to its economic importance in Cuba. After a brief statement of its life history, a considerable number of countries in the New World are mentioned as suffering from the depredations of *Diatraea saccharalis*, while Mauritius, Java, Ceylon and Formosa are given as examples of countries where other species of Diatraea are met with. Three forms of moth borer are found in Cuba : *D. saccharalis*, *D. lineolata*, and a small species of Phyticinae. *D. lineolata* is noted as the "larger corn moth stalkborer" ; and the last mentioned form has only been found on young shoots, where its work closely resembles that of the moth borer in the appearance of dead hearts. The Cuban parasites of *D. saccharalis* are given as follows : *Trichogramma minutum*, *Euzenilliopsis diatraeae*, *Sarcophaga sternodontis*, *Apanteles diatraeae*, *Bassus stigmaterus* and the fungus *Isaria* (*Coryceps*) *Barberi*. The damage done by the moth borer is then discussed, and figures are given showing decreased sucrose and purity in the juice of bored canes and an increase of glucose. Details are also given of a study of the estimated losses on 11 centrals distributed over three provinces in Cuba. The average infestation of the canes was 19 per cent., and a loss in sugar of 67,000 bags out of a total of 2,885,000. Control measures are treated along the usual lines, emphasis being laid on the proper rotation of harvesting in the fields, and the general speeding up of all operations between the cutting of the canes and passing them through the mill.

PARASITES AND HYPER-PARASITES OF *Diatraea saccharalis* IN TUCUMAN SUGAR CANE. **Juan Brèthes.** *Revista Industrial y Agricola de Tucuman.* Vol. XVII, *Nos.* 7-8.

A translation of this paper has been kindly provided by Dr. CROSS. It consists of purely scientific descriptions of four newly discovered insects, parasitic on the common moth borer and on its parasites. There are no references to the places of occurrence, habits, distribution, or relative abundance but the paper provides valuable data for the economic entomologist to work upon. From internal evidence, three of the insects described would appear to be parasites on Diatraea : *Microdus Crossi*, n. sp., *Ipobracon tucumanus*, Brèthes, and *Sarcophaga diatraeae* n. sp. The fourth, *Aulatopria tucumanus*, n. gen. n. sp., is parasitic on the Sarcophaga.

THE INTRODUCTION OF BRACONID PARASITES OF *Diatreaea saccharalis* INTO CERTAIN WEST INDIAN ISLANDS. **H. E. Box,** Entomologist, Agricultural Experiment Station, Tucuman, Argentina. Bull. Entom. Research. XVIII, 4th May, 1928.

This is an account of several years' work of the author in introducing parasites of the moth borer of the sugar cane into Porto Rico, while occupying the post of Entomologist to the Central Aguirre Sugar Company on the south coast of that island. The only parasite of the moth borer indigenous in Porto Rico is stated to be *Lixophaga* (*Euzenilliopsis*) *diatraeae*, and it alone does not appear to effect a sufficiently high percentage of control of the borer. Species of Ipobracon and Microdus were introduced from British Guiana in 1924-1925

and the latter at any rate appears to have settled in its new habitat. In the two following years further collections were made, especially of Ipobracon, in Venezuela which was much nearer in transit time than British Guiana, and these were safely landed in Porto Rico and let loose in the fields. And during these visits the officers in Trinidad and Barbados were interested, and the author was able to assist them in introducing the parasites into Barbados, Antigua and St. Kitts, where heavy toll is taken in the fields by the borer.

Trinidad appears not to suffer greatly, because of the presence of numerous parasites both on the eggs and larvae of the moth borer, coupled with the important fact that burning the fields immediately before harvesting the canes is not the custom, as it is in British Guiana. This practice is universal in the latter country, thus destroying countless numbers of the parasites which infest the fields; and the author adds his testimony to that of others, that if this practice could be discontinued, the status of the moth borer would soon approach that in Trinidad. A description is given of the extremely handy and efficient cage devised for the transmission of the parasites from one island to another. This is a matter of great importance in such work, because of the comparative slowness of connexions by steamer in certain cases. For instance, the journey from Venezuela to Porto Rico is accomplished in four days, while that from British Guiana has to pass through Trinidad to Venezuela before a passage to Porto Rico can be obtained. Another item worthy of emphasis is the feeding of the parasitic " flies " while occupied in their beneficient work. It was observed by the author that they swarmed round a small plant, *Cordia interrupta* in British Guiana. Seeds of this plant were accordingly introduced to Porto Rico. and it is recommended that it should be grown along the borders of the cane fields wherever the borer is a menace. The work described in this paper appears to be of an extremely important character and, although the author repeatedly insists that it is only of a preliminary nature, and that results cannot but be slow in materializing, great credit is due to the energetic way in which he has set the ball rolling. It will be interesting to follow the course of events during the next few years, if the various countries suffering from moth borer follow up the lead given in the same whole-hearted manner.

THREE HELMINTHOSPORIUM DISEASES OF THE SUGAR CANE. **J. A. Faris.** Phytopathology, Vol. 18, No. 9, September, 1928. *Reprinted as Scientific Contributions. No. 12, Tropical Plant Research Foundation.*

This is a technical paper which endeavours to clear up misconception as to certain leaf spot diseases of the cane, which have become confused. The work is important because,while some of these particular leaf spots appear to be more or less harmless, others have caused considerable damage to the canes; and there is a very distinct variation among different varieties as to their susceptibility to the harmful ones. Before referring to FARIS' work, a few words of explanation will be useful.

BUTLER in 1913 described an Indian leaf spot, of little economic importance locally, under the name of *Helminthosporiose*; and found that it was caused by a new species of fungus which he described as *Helminthosporium Sacchari.*[1] He also drew attention to a Java disease called eye spot, which was attributed to a fungus described as *Cercosporium Sacchari.* From the description, he pointed out that this was not strictly a Cercosporium but a Helminthosporium, and one which was very closely allied to the one which

[1] Some new sugar cane diseases. E. J. BUTLER and ABDUL HAFIZ KHAN. *Mem. Dep. Agr. Ind.' Bot. Ser.* VI, 6, December, 1913.

he had named. ATHERTON LEE, in 1926, described an eye spot disease in Hawaii which was already well known as specially destructive to H 109,[1] and ascribed it to BUTLER's species of *Helminthosporium* ;[2] and it appears to have become the custom to follow this lead in other New World countries where eye spot has been met with.

The author, in studying the eye spot disease, which is widespread and sometimes does considerable damage in Cuba, went very carefully through the whole literature, with the following result. The eye spot of Hawaii and Cuba, also found in Porto Rico, San Domingo and Florida, is similar to that in Java ; while BUTLER's species causes a different disease. Agreeing with BUTLER's suggestion that the Java fungus is a *Helminthosporium,* he describes the eye spot as caused by a new species which he calls *H. ocellus.* The chief data for this separation are the character of the conidiophores and the length of the spores, character of the spot, and part of the leaf attacked. The details given in the paper are of too technical character to be reproduced here. But the Table given of the relative susceptibility of the canes grown in Cuba is of more economic importance. Taking out the better known canes from the six groups, arranged from high to low susceptibility, we have I. D 109. II. H 109, POJ 36, POJ 100. III. B 3412, B 6308, Sealey's Seedling. IV. Yellow Caledonia, D 1135, B 3405. V. BH 10 (12), B 4596, B 6032, EK 28, POJ 2714, POJ 2725, SC 12 (4), Cristalina. VI. D 117, Badila, POJ 2727, Uba, Co 281, D 116, POJ 36, Kavangire, B 1809, B 1753. The latter class is of course practically immune.

As control measures the author advises that canes of the first group should not be planted, and the second group should not be planted in humid regions. And any new kind of cane introduced into Cuba should be tested as to its susceptibility because of the wide distribution of the disease. Recently a third *Helminthosporium* leaf spotting has been found attacking Cristalina canes throughout Cuba, and this has been carefully studied by the author, who has named the disease Brown Stripe, and finds that it is caused by *H. stenospilum,* Dreschler. From the Table of susceptibility to this leaf spot it is at once seen that there is a great difference in the arrangement of the kinds of cane in the four groups given, although the varieties tested are very different in the two cases. For instance, Cristalina and BH 10 (12), which are " rarely spotted " with eye spot, are " very susceptible " to brown stripe. For details regarding this disease and the fungus causing it, the reader is referred to FARIS' original paper.

A LEAF ADAPTATION CONDUCIVE TO MOSAIC RESISTANCE IN THE SUGAR CANE. **T. S. Venkatraman and R. Thomas.** *Agricultural Journal of India.* Vol. XXII, Part I. January, 1928.

The following extract from this short paper speaks for itself. It is very much on the lines of recent studies in the resistance of cotton varieties to the attacks of mites. The smooth leafed forms are so severely attacked in certain countries that it is impossible to grow healthy plants. whereas hairy forms which have been evolved from them by breeding work have been proved to be quite resistant.

" Though different views are entertained about the exact nature of the mosaic disease and the actual mode of transmission, there is a general consensus of opinion among cane pathologists that the disease is insect-borne. Assuming this to be so, it is obvious that any peculiarity in the leaf, rendering it inconvenient or difficult for the insect either to visit it or introduce the virus into the tissues. would conduce to mosaic resistance.

[1] *I.S.J.*, 1920, p. 139. [2] *I.S.J.*, 1926, pp. 585-589.

" Going through the recorded resistance or susceptibility of the different varieties to mosaic there is one cane which, at the present time, is widely acknowledged as immune, viz., Kassoer. Even its seedlings have been found to be immune and this immunity is attributed to one of its parents Glagah—a grass which also has been found to be immune.

" The leaves of Glagah show on the surface sharp stiff unicellular bristles which, from their position and arrangement, would protect the stomata and the surrounding regions from the attention of insect visitors. In Fig. 1, which is based on a camera lucida drawing, the bristles are seen shaded with lines. The leaves of Kassoer show a similar adaptation and the inference is rather attractive that the immunity of Kassoer is probably due to its inheritance of these bristles.

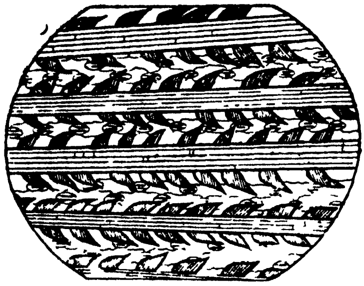


Fig. 1.
GLAGAH.

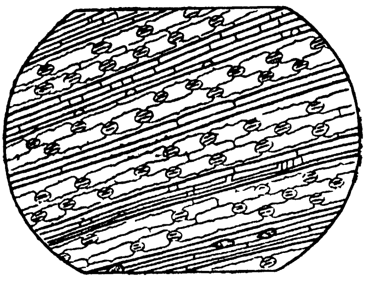


Fig. 2.
STRIPED CHERIBON.

" At the other and opposite end, we have the large number of broad and soft leafed varieties, very susceptible to mosaic. A careful examination has shown that these either do not possess the bristles or show them in such small numbers as to be ineffective as a protective arrangement (Fig. 2). Other variations have also been noticed in the number, size, shape, nature and arrangement of the bristles, suggesting an obvious correlation with their efficacy as protection. The susceptible varieties so far examined include :—Poovan, Co. 1, Red Mauritius, Purple Mauritius, Java (Hebbal), D.74, A.2, A 95, B 147, B 254, B 1528, B 6346, B 6388, BA 6032, B 6308 and Vellai.

" Of the wild Saccharums, *Saccharum Narenga* has been found susceptible and it is devoid of the bristles herein mentioned.

" The bristles and their arrangement are easily seen in reflected light with a powerful lens. For detailed examination, either thin surface sections may be taken or the leaf thinned down to almost the surface layer, by repeated scrapings from the opposite side with the razor. These bristles are found both in the unrolled leaves and in the leaves which are in the process of rolling out—just the regions now considered to be the first recipients of the insect-borne virus.

" The efficacy of the protective arrangement becomes apparent, when it is remembered that the surface of a cane leaf consists of a series of longitudinal ridges formed by the veins, and the stomata are found in slight depressions of the surface in between the veins. The epidermal cells above the veins are thick-walled and are, therefore, perhaps well protected. Dr. BRANDES has shown that " with *Aphis maidis* the beak is usually placed on the cuticle covering a stomate guard cell at the point where the cuticle is thinnest and setae thrust into the latter by pressure." The arrangement of the hairs is such that they would come in between the insect and the vulnerable points on the leaf surface, viz., the stomata."

C. A. B.

British Beet Sugar.

Notes on Cultivation and Manufacture.

Cultivation.

1928 *Results* : Mr. E. Gaspart, Belgian Expert for Bardney factory, issues a report[1] in which he says that cultivation this year has shown a decided progress on last year, offering also some useful advice, which should be of general interest. The best time for sowing is from 15th April to 10th May in normal seasons, as after that date one must have especially favourable climatic conditions if one is to obtain a really good paying crop. Early sowing sometimes produces a large number of "bolters," but even then the early sown crop produces a good harvest for the reason that those roots which have not bolted are well and early matured and of good size. For small acreages the best results are usually obtained by drilling before 1st May, but on the larger farms where sowing must be more gradual so that the gapping and singling out does not all become due at the same time, sowing must, of course, start earlier than this in order that the whole of the crop may be finished drilled about the 10th May.

Unfortunately, throughout the whole of the county, a very grave mistake has been made in planting at too great a distance between the rows. One finds that this distance is often 20 in. and even 22 in., with the result that it is impossible to obtain the most favourable stand which should be 25,000 to 28,000 sugar beetroots per acre. Those farmers who have adopted a distance of 18 in. between the rows have generally sufficient stand and a very good distribution of roots in the soil, and they can, therefore, single the beet wider. With a distance of 18 in. between the rows the gapping can be done to 12 in. If this is done, even with the few inevitable empty spaces, one obtains a good crop and, naturally, both soil and manure are better utilized by the roots. It is essential that manures be well balanced in order to produce the biggest roots with the highest percentage of sugar, and in order to produce a normal maturing and early ripening of the plant.

It is not possible nowadays, to make a profit in farming unless the soil is made fertile and clean. Nearly everywhere throughout the country it is necessary to use lime, and the most favourable moment for this operation is at the end of the corn harvest. In addition, farmyard manure should be applied early in the autumn and the deep ploughing done before winter on all soils where mellowing is made difficult by spring operations. When the necessary care in cultivation has been taken, there is no doubt that sugar beet will be successful on the very great majority of soils. In conclusion one should bear in mind that with proper working and good manuring, sugar beet can be repeated frequently on the same fields without undue worry regarding the rules of rotation. There are, on the Continent, numerous fields where sugar beet is repeated every third year, and even every second year over a long period.

Beet tops : Mr. J. K. Thompson, Director of the Kirton Agricultural Institute, has published some notes of a conversation with Dr. Rabbethge, head of the beet house of Klein-Wanzleben, Germany, on German practice in regard to the utilization of beet tops. On being informed that in this country we made little use of the tops, other than ploughing them in as a green manure, he said that in Germany all the beet tops are used for feeding to stock, and with sugar beet then at a very low price, the Germany farmer depended on his profit from beet indirectly through his stock. This in its turn supported the sugar beet crop through the fold-manure made, which was the basis of the

[1] *Lincoln Echo.*

manuring of sugar beet in Germany. Beet tops thus held a very significant and important place in that industry.

The German beet farmer, then, is a stock farmer, farming in general an ordinary four-course rotation, much similar to our Norfolk four-course "shift" associated with and dependent upon stock farming in much the same way as is our mixed farmer, the difference between the German rotation and ours being that the German farmer grows sugar beet where we grow mangolds, swedes, or turnips. His sugar beet takes the same place in his winter feeding as the root crops take in ours, except that he uses the leaves and crowns for feeding, thus receiving a direct cash return from what is otherwise a very expensive break in the rotation. The value of the beet tops as fodder has been proved by long experience in Germany, and in this country the work already done at Cambridge, principally by Dr. WOODMAN, is entirely favourable and confirmatory.[1] The tops—fresh or converted into silage—may be used in feeding in substitution for roots. They contain more dry matter, and are really more comparable with succulent green fodders.

The British farmer may consider that he will get equal value from his tops by ploughing them under as a green manure. It is a fact, however, that much of the feeding value of the tops has no manurial value and must be entirely lost by being ploughed under, whereas, if fed to stock, all the feeding value is gained and much of the manurial value will appear in the manurial residues. Thus, the feeding of the tops must mean making the most of them.

The farmer must never collect the tops into large heaps, or fermenting or rotting, due to the pressure, will soon set in. The tops must never be fed in an unwilted condition ; after topping they should be allowed to wilt a day or two before use. Wilting reduces the content of oxalic acid to comparatively safe limits, but it is advisable to feed along with the fresh tops precipitated chalk, at the rate of 1 lb. of chalk to 250 lb. of tops. Fresh tops should always be associated with good quality dry fodder.

The tops which cannot be consumed fresh should be ensilaged for use during the winter and early spring. Where a tower silo is available, it may be used, but the silo may be built in the open or in the form of a heap or stack, being finally cased in with a good thickness of soil, not less than a foot. German practice is to allow a breadth of 14 ft., and a height of 7 ft., and a length of 5 ft. for each acre of roots. This, of course, must vary with the weight of tops per acre, but it is the length that is varied, the other dimensions being fixed.

MANUFACTURE.

Effluents : Under this heading the most important publication to be noticed is the Report of the Water Pollution Research Board for 1927-28, just published.[2] This gives a very good review of the work being done on the problem of beet factory effluents. At Colwick two experimental biological filters, 25 ft. in diam. and 6 ft. deep, made up with four different media, have been constructed. Results obtained so far appear to lead to the view that biological filtration may form a practical solution, though the investigation is still in progress.

Research aiming at identifying the organisms found on the biological filters, tracing the growth of the film on the filter medium, and determining its general behaviour as well as the inter-relations of the various organisms it contains, is being carried out in co-operation with the industry, which has contributed £1000 to the cost on the recommendations of the Effluents Sub-Committee of the Beet Sugar Factories Committee. Experiments are also

[1] *I.S.J.*, 1928, 593. [2] By H.M. Stationery Office, price 6d.

being carried out at Rothamsted Experimental Station, where valuable information has already been obtained and the biological filtration method has been suggested, having been found to give better results than fermentation with lime or bio-aeration with activated sludge. Assistance has been given by the industry generally to the full-scale investigation of fine-screening and mechanical filtration which has been carried out at considerable expense by The United Sugar Co., Ltd., Bury St. Edmunds. In addition individual factories have carried out practical experiments at their own cost.

Following this, the Report gives some general observations arising out of a consideration of the whole problem of the formation and the disposal of beet factory waste-waters. In the first place, it is suggested that the ideal solution is so to modify the present processes that waste-waters do not require to be discharged, being re-used. Neither the transport and root washing water, nor the process water (diffusion battery and pulp-press waste-waters) is fit for re-use as it stands. The first might be treated in detritus tanks for the removal of grit, sand, and other heavy material, then in a graded series of screens for the removal of leaves and beet debris, and finally in sedimentation tanks for the separation of the bulk of the remaining suspended solids. Water thus treated would however, still contain sugar, which would accumulate, so that it would seem desirable to discharge a proportion of it, say 10 per cent., making up the loss with fresh water.

Regarding the treatment of the process water, it is suggested that this may also be submitted to screening and sedimentation, while being maintained at a high temperature and also treated with lime or chlorine to check fermentation. It is believed that steps along these lines would render the re-use of the waters feasible, though owing to their sugar content they would require further treatment before being discharged at the end of the campaign to a stream. At present, however, the Board does not know of any process for the elimination of the traces of sugar which they can recommend. They are watching the progress of the double fermentation, fermentation-putrefaction and other processes which have recently been introduced at some beet factories in this country and abroad.

C. S. HUDSON, formerly with the U.S. Department of Agriculture, and the Bureau of Standards, has now been appointed Chief of the Division of Chemistry of the Hygienic Laboratory of the U.S. Public Health Service.

The new Secretary of Agriculture in the Philippines Government, Mr. R. R. ALUNAN, has had many years' experience as a cane planter and also as administrator of a sugar central, and has filled the post of President of the Philippine Sugar Association. He is therefore well equipped for furthering the cause of the sugar industry in the counsels of his Government.

Comparative experiments with cane and beet sugar, or rather with British refinery and British beet factory sugar, carried out at the Fruit and Vegetable Preservation Research Station, Campden, Glos.,[1] lead to the conclusion that "there is no indication whatever that British beet sugar is in any way inferior to the refined product for use in jams, jellies, and canned fruits." Examination of the sugars used, (*a*) LYLE's No. 2, and (*b*) Ely beet granulated, gave the following results :—appearance, (*a*) pure white, (*b*) slightly greyish-brown ; odour, (*a*) slight) (*b*) characteristic beet sugar odour ; sucrose, (*a*) 99·94, (*b*) 99·71 ; invert sugar, (*a*) trace under 0·05 per cent., (*b*) trace under 0·05 per cent. ; moisture, (*a*) 0·02 per cent., (*b*) 0·05 per cent. These results corroborate numerous others, comparing cane and beet sugars of high purity.

[1] *Journal of the Ministry of Agriculture.*

Beet Factory Technical Notes.

A good deal of interesting literature is published in the Continental sugar technical press, and a survey of what is passing in this direction is of importance to the British beet sugar man. It is proposed, at least during the campaign, to provide our readers with a digest of the most important of such papers published in France, Belgium, Holland, Germany, Czecho-slovakia, and elsewhere.

De Vecchis Process.—Everything of importance written on this dehydration process has been noticed in this *Journal.*[1] Now comes a report by ARNOLD KUHNER, a Czecho-slovakian consultant, who has visited the original plant at Sanguinetto, where the process is being operated. He is evidently impressed with the advantages of the process, though he remarks that the factory arrangements are very defective. In spite, however, of the lack of adequate arrangements, such as the automatic transport of the slices, the white sugar (pilé and granulated) is faultless. This must be credited to the process itself, i.e., the drying apparatus, and the purification of the juice, which indeed together constitute the process. The quality of the dried slices leaves nothing to be desired.

Samples were taken and analysed under the supervision of KUHNER, some of the results obtained being as follows : sugar in the fresh slices, 13·20 per cent ; in the dried slices, 63·12 ; in the exhausted slices, 0·18, 0·32 (dry matter 6·1 compared with the normal 4·5 due to the higher albuminoids). Sugar in the waste waters, 0·06, 0·14 ; sugar in the scums, 1·20, 2·20. Raw juice, 44·20° Bg. ; 36·9 sugar ; 83·2 quotient ; defecated juice, 41·72° Bg., 35·6 sugar, 85·5 quotient ; first product massecuite, 93·45 Bg.,° 82·6 sugar, 88·4 quotient ; second product massecuite, 95·4°Bg., 72·4 sugar, 75·3 quotient ; and molasses, 77·75°Bg., 44·0 sugar, 56·5 quotient Total sugar produced, 13·23 ; sugar in the molasses, 2·17 ; and sugar lost (in slices, scums, and undetermined), 1·30 per cent. The loss figure is normal.

In general, KUHNER is in agreement with English opinions on the process, namely, that no loss of sugar occurs in dehydration ; drying to 3 per cent. water can certainly be realized ; the juice can be easily clarified ; waste waters do not contain nitrogenous substances ; only 0·25 to 0·3 per cent. of lime is required, and 0·5 per cent. of 14-16 per cent. superphosphate. He hesitates to give estimates for the plant to form an idea of the economy of the method, the cost of building material and wages being so different in Italy, but he has been very well impressed with the process. The greater cost of the dehydration plant is offset by the elimination of lime-kilns, scum-presses, saturation tanks and evaporators, not to mention also material, such as, coke, press-cloths, and the fuel used in the evaporating station.

Yield Formulae.—K. SMOLENSKI, a well-known Russian beet factory chemist, has worked out formulae for the yields of white sugar and of molasses in white and in raw sugar productions these being : White sugar production, yield of white sugar calculated on the roots : $= (c—s_1) . (1—aK)$. Yield of molasses : $= \dfrac{100\, a(c-s_1)(K+1)}{B_2}$. Raw sugar production yield of raw sugar : $= \dfrac{100(c—s_1)(1—aK)}{Rt}$. Yield of molasses $= \dfrac{100\,(c—s_1)(K+1)}{KB_2}$ $\left[1 - \dfrac{(1—aK)\quad C_3}{Rt}\right]$. Raw and white production, yield of white sugar =

[1] *I.S.J.*, 1927, 474 ; 1928, 384, 440, and elsewhere.

$\frac{100E\ (c-s_1)\ (1-aK)}{100E+Rt}$. Yield of raw sugar $= \frac{100\ (c-s_1)\ (1-aK)}{100E+Rt}$. Yield of molasses : $= \frac{100\ (c-s_1)(K+1)}{KB_2} \times \left[1 - \frac{1-aK}{100\ E + Rt}\ (100\ E+C_3)\right]$ In these formulae the letters used have the following meanings : c = sugar in the sweet slices ; s_1 = total sugar losses up to first massecuite ; q_1 = quotient of the first massecuite without syrup (or of the thick-juice) ; $a = \frac{100 - q_1}{q_1}$; q_2 = quotient of the molasses ; $K = \frac{q_2}{100-q_2}$; B_2 = saccharization of the molasses ; Rt = rendement of the raw sugar ; C_3 = polarization of the same sugar ; $E = \frac{V'b}{V's}$ = ratio of white and raw sugar productions.

Pressure Evaporation.—At the Oroska factory (Slovakia) in addition to an evaporator working in the usual manner under vacuum, they recently enlarged the concentrating station by the addition of a so-called pressure evaporator, and the manager of the factory, Janko Prochazka, now compares the results given by the two systems from the point of view of white sugar production. Following are figures indicating the colour development expressed in degrees Stammer per 100 of polarization :—

	Pressure Evaporation		Vacuum Evaporation	
	Morning	Noon	Morning	Noon
Thin-juice	10·5	10·90	11·0	13·15
First body	16·0	15·80	12·0	14·10
Second body	18·5	15·90	12·6	14·40
Third body	22·4	18·40	13·0	14·80
Fourth body	23·9	20·70	13·6	14·90
Polarization of the thick-juice	59·8	53·60	54·0	54·90
Beet working in 12 hours, quintals	8834		9249	

There would therefore seem from these figures to be no doubt as to the superiority of the vacuum system for white sugar production. Theoretically, as the juice in constant motion there would appear to be no reason why that from pressure evaporation should develop more colour, though the temperature is higher. It is a matter of the absolute regularity of thin-juice inflow and of thick-juice draw off, and this is unfortunately not realized in practice. It is the opinion of this writer, morever, that pressure evaporation does not concentrate more rapidly than vacuum evaporation. He concludes that for factories making white sugar from their thick-juices pressure evaporation is not of interest, though it may find use in raw sugar factories.

Methods of Analysis.—Most beet producing countries have adopted a system of " uniform chemical control," by which all the factories adhere to the adopted methods of sampling and analysis and of calculating and of reporting the results. A study of such control systems should be of great interest to the British beet chemist, in view of the desirability of elaborating a similar scheme for the factories in this country. Czecho-slovakia has just published her " Introduction to Chemical Examinations in Sugar Factories according to Uniform Methods," as drawn up by a Commission of prominent chemists including K. ANDRLIK, O. FALLADA, FR. HERLES, V. SAZAVSKY, K. SANDERA, J. VONDRAK, O. WOHRYZEK, and others. Some notes on the

methods, which are too lengthily described for reproduction in full here should be of some interest.

For the determinarion of sugar in the beets, which are pulped by the Stanek rasp, 52·0 grms. are weighed into metal digestion cups, and 356·4 c.c. of dilute lead acetate are added by means of an automatic pipette, the cup being closed and shaken and placed in a water-bath at 80-85°C. for half an hour, and shaken repeatedly during this time. After cooling to 20°C., the cup is again shaken, opened, and the contents filtered and polarized, using the 400 m.m. tube, which gives the sugar content of the beet directly. Fresh slices are prepared for analysis by means of the "Keystone," meat-mincing machine, the 10 hole disc being used; or they may be subdivided by means of the "Rekord," "Max," or "Ideal" No. 22 machines. After mixing the fine material thus obtained, it is examined as just described above.

Previous to determining the Brix of the diffusion juice, it is placed in a vacuum vessel showing a pull of at least 50 cm. of mercury for 5 to 10 minutes, in order to evacuate the air present. Carbonatation juice (hourly samples preserved with thymol and examined every 8 hours) is examined for apparent dry substance by means of a pycnometer having a capillary tube, or the refractometer may be used, either the dipping or the so-called sugar type. Its colour is taken by the Stammer instrument, preferably illuminated in the manner recommended by SAZAVSKY[1]. Lime is determined by CLARKE's method, or by titration with potassium permanganate, or again by titrating with standard acid and calcium carbonate precipitated by the addition of sodium carbonate.

The method of determining sugar inthe carbonatation press-cake is not usual: A weighed amount of the material is shaken with a solution of zinc nitrate, until all the lumps are broken up, after which the liquid is simply filtered and polarized, thus giving total sugar, i.e., both free and combined. Condense water as taken from the several vessels of the evaporator is examined for traces of sugar by the well-known Skärblom method. Molasses is tested for sugar content by a method which departs little in detail from the usual procedure: The direct polarization is obtained from a solution clarified by means of HERLES' method (lead nitrate); while the inversion polarization is obtained by hydrolysing 50 c.c. in a 100 c.c. flask with 30 c.c. of dilute HCl (obtained by diluting 17 c.c. of 1·188 acid), the heating being carried out in a water-bath of 1 to 1½ litres at 71°C., in such a manner that the temperature of the contents of the flask reaches 67°C. in 3 min., after which the heat is kept at 67-69°C. for another 5 minutes. In regard to hydrogen-ion concentration, the desirability of instituting this method of controlling the reaction is emphasized, but unfortunately no details are given for carrying the recommendation into effect. This very useful report is completed by directions for the calibration of glassware (flasks, pipettes, etc.) and of instruments (as saccharimeters and refractometers), as well as by a very complete list of the necessary apparatus and reagents for a beet sugar factory laboratory.

"The modern housewife appreciates the excellence of beet sugar as it is marketed to-day. She knows that the jellying process of fruit pectin, and that the use of imported sugar makes absolutely no difference in the success or failure of her jellies or preserves. Since chemical analysis fails to reveal the slightest difference in the composition of beet and cane sugar it has definitely laid to rest the old superstition in the minds of well-informed housewives."[2]

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1922-23, 47, 64. [2] *Burley (Idaho) Herald.*

Correspondence.

"JAVA versus CUBA."

TO THE EDITOR OF "THE INTERNATIONAL SUGAR JOURNAL."

SIR,—Circumstances have prevented me from taking earlier notice of what you have published under the title "Java versus Cuba" in your September number, but I hope you will still give me an opportunity of furnishing your readers with some more information on the subject, touched upon by Mr. Golodetz.

I am more especially referring to the story, related by Mr. Golodetz, about a certain Java sugar concern, which distributed to its shareholders for 1927 dividends in excess of 90 per cent. Mr. Golodetz in his Market Report evidently did not mention the name of this particular company, so that I am not in a position to make a survey of the balance sheet; but it is not at all improbable that such a company really exists, and we can take it, therefore, that Mr. Golodetz's story is based upon facts.

However, does this prove that Java sugar growers, at least some of them, enjoy a sugar-heaven on earth, being practically certain of huge profits altogether disproportionate to the capital invested? The way Mr. Golodetz phrases his remark makes me think that he would reply to this question in the affirmative. By doing so, he would entirely overlook the fact that it is a special feature of Java sugar concerns that their nominal capital stands in no proportion to the real amount invested in their business. Several companies, originally started with a very modest nominal capital, have in the course of years paid all cost of further extension of their area and milling outfit out of the profits *not* paid as dividends to shareholders. Hence the actual amount invested by shareholders in a particular mill may not be judged merely by looking up the nominal capital on the balance sheet, but should be found by adding to it all the sums held back from distribution and used as fresh capital. Some five years ago this matter was gone into very carefully, for fiscal reasons, by both the Government accountants and the concerns themselves, and these investigations have shown that in several cases the nominal capital is only a fraction of the real capital employed in the business. It stands to reason, in view of this, that dividends may not be judged on their absolute percentage, but should be seen in relation to the real capital, a procedure which some companies follow in their yearly reports, so as to avoid misunderstandings similar to the one which has led Mr. Golodetz to make mention of this "story."

Mr. Golodetz, after having given credit to the highly developed technique both on the agricultural and factory side of sugar production in Java, also mentions "cheap native labour" as one of the factors leading to "the lowest cost of production." I do not think that sufficient data are available as regards cost of production in Java and elsewhere to justify giving to the Java producers the palm of lowest cost; but what I do know is that, as "capital" cannot be judged by the nominal face value of it, cost of labour cannot be measured merely by shillings and pence. "But that is another story."

I am, Sir,
Yours faithfully,
G. A. P. WEYER.

The Hague,
December 17th, 1928.

Chemists should note that it has been found that solutions of thiosulphate as used in volumetric analysis can be stabilized by the addition of 0·01 per cent. of mercuric cyanide. It is stated that solutions thus treated remain clear and stable for at least two months. This is a very useful observation.

Publications Received.

A Guide to the Literature of Chemistry. E. J. Crane and Austin M. Patterson. (Chapman & Hall, Ltd., London.). 1928. Price : 25s. nett.

Part of the chemist's equipment is the necessary knowledge of the manner in which a search of the literature on any subject should be conducted. It may be a search bearing on some historical point, on a new process of manufacture, on some analytical procedure, or again on matters bearing on the value of a patent specification. As the preface to this " Guide " explains : " The literature of chemistry is like a great inspiring mountain with a core of rich ore . . . . To obtain anything like full profit in its use, one must learn how to climb this mountain, and how to dig for the ore one needs." Both of these American authors are qualified in the highest degree by reason both of knowledge and experience to write a book having this purpose in view. They analyse the various possible sources of information, such as books, periodicals, bulletins, theses, patent specifications, etc., giving the best of practical advice under each heading. They discuss the procedure to be followed in making a systematic examination of the literature, and in compiling a record or report of the information that has thus been culled. Moreover, they have written two chapters which will be found very useful by many, the first on systems of indexing and the second on the cataloging of libraries. Considering the volume as a whole, one feels confidence in remarking that it is one of the most valuable accessory textbooks for the use of the chemist that has been published in recent years. Its authors have treated the literature of chemistry without national bias (as indeed they should), the reader in fact being asked in the preface to excuse the rather frequent reference to *Chemical Abstracts* ! There are appreciative notes on British libraries and publications, of which we on this side are justly proud. Our own modest publication is mentioned several times. In one reference a sugar chemist, who was asked for his experiences in making searches, states that he has found the files of the *Sugar Cane* and the *International Sugar Journal* to be " very valuable " ; while elsewhere it is remarked that " this little journal should be in every sugar chemist's library."

Determination of Hydrogen-ion Concentration and its Application. J. A. Kucharenko and B. G. Savinov. (Sugar Experiment Station, Kiev, Ukraine.) 1928.

This monograph (in Russian) must comprise the most complete compilation of information on H.I.C. and its application in the sugar industry. It is excellently written and adequately illustrated. Something as good in English would, it is certain, be greatly appreciated. A few points from the summary are abstracted elsewhere in our columns.

Starch : Its Chemistry, Technology, and Uses. Lewis Eynon, B.Sc., F.I.C., and J. Henry Lane, B.Sc., F.I.C. (W. Heffer & Sons, Ltd., Cambridge). 1928. Price : 12s. 6d.

A modern textbook on starch, particularly on the technology of starch and its practical application in the industries, is much wanted. Messrs. EYNON and LANE have now compiled a volume which should do much towards filling this lacuna. They have collected a quantity of reliable information dealing with the chemistry of starch, its constitution, its microscopy (with 32 excellent figures of various varieties), and with the modern manufacture of potato, wheat, rice, and maize starches. There are also sections on starch products and their application, and the book is concluded with an excellent chapter on the determination of starch, and the analysis of starchy materials. It should prove a useful book for the student and the analyst, and it should certainly also serve as a handy work of reference to the chemist in general practice.

Manual of Sugar Companies, 1928. (Farr & Co., 90, Wall Street, New York). Free on application.

This ninth edition, revised and enlarged, of a manual issued by a New York firm of sugar brokers, who also deal in sugar securities, is a compact reference book for investors interested in American sugar companies. It describes 100 different companies, and of these gives in the case of 25 important Cuban, Porto Rican, and

American firms statistical reviews, while the remaining 85 have each a brief summary of capitalization and ramifications. The new Sugar Institute Inc. is described with its code of ethics, and its functions explained. A useful reference book, both for investors and for students of the commercial side of the industry.

Notas sobre la Industria Azucarera del Hawaii. (Notes on the Hawaiian Sugar Industry). By Gerado Klinge. (Sanmarti & Cia, Lima.) 1928.

This is a 220-page booklet, well stocked with plate illustrations from photographs, which describes the impressions of a four-weeks' visit paid to Hawaii by Mr. KLINGE, a leading Peru agronomist, acting on behalf of the Sociedad Nacional Agraria of Lima. Hawaiian practice is explained at length, and those Spanish sugar industrialists who have hitherto had to depend on English literature for their information will now be able to study in their own language the principles and practice of the most up-to-date and thorough of the American sugar-producing organizations.

History and Development of the Beet Sugar Industry. By H. A. Austin. (U.S. Beet Sugar Association, 1180 National Press Building, Washington).

A short and popular explanation of sugar and its uses, by the Secretary of the U.S. Beet Sugar Association, with special emphasis on the value of beet sugar—as a food, as an object of indigenous production for the farming community, and as a means of protection against price ramps on the part of foreign producers of tropical cane sugar. The economic point of view urged is of course primarily for Americans, though the arguments are not without their use for other countries, e.g., the United Kingdom.

(1) **Standards of the Hydraulic Society.** (The Hydraulic Society, 90, West Street, New York.) 50 cents. (2) **Trade Standards.** (Adopted by the Compressed Air Society, 90 West Street, New York). 50 cents.

The Hydraulic Society is an American trade association, comprising the manufacturers of displacement and centrifugal pumps in the States; it has laid down standard definitions, terms and practices where such action appears to be feasible, and has incorporated them in a " Standards " pamphlet of some 80 pages, which it is believed will be of advantage to the engineering profession, as well as to purchasers and users of pumps. The Compressed Air Society has likewise produce a " standards" pamphlet as an assistance to compressed air engineers; and the users of apparatus such as pneumatic tools, drills and pumps will appreciate the establishment of definite trade standards in this industry also.

We regret to announce the death of Mr. JOHN R. BOVELL in Barbados, whose name will always be associated with that of the late Sir JOHN B. HARRISON in connexion with the re-discovery in Barbados of the fertility of sugar cane seed, a discovery which has had such wide-reaching results and the promise of yet more important ones to come. In his early days BOVELL was an estate manager; later, after his famous series of experiments he was put in charge of the Barbados experiment station. Latterly he made his home in Trinidad. Many feel that he never received sufficient credit for his work, though he was given the I.S.O., and a cheque for £1000 by the Barbados Government on his retirement in 1925.

WM. E. SMITH recently published a paper[1] in which he resumed the data on the removal of dissolved oxygen and carbon dioxide from boiler feed-waters with the object of diminishing corrosion. In one type of deaerator the gases are removed by explosive boiling of the water as it flows through the apparatus. This is accomplished by maintaining the deaerator under a partial vacuum and heating the inlet water to a temperature sufficiently high that a portion of it flashes into steam as it enters the equipment. Some types of deaerators working on this principle eliminate all the dissolved oxygen and free carbon dioxide. Such treatment is now generally conceded to be a necessity in modern power-plant practice.

[1] Extracted from a Paper presented to the 7th Annual Meeting of the Hawaiian Sugar Technologists' Association, Honolulu, T.H., October, 1928.

Brevities.

It is proposed to use molasses as a substitute for core oils and core gum for use in the foundry, in order to impart to the sand or "composition" the desired constituency. It is found when very thoroughly incorporated to maintain the proper rigidity and generally to suit the purpose for which it is intended.[1]

It is being urged in certain quarters that the Patent Office, London, should adopt a short term system (five or seven years), similar to the *Gebrauchsmuster* protection as adopted in Germany, for small variations in forms of mechanical construction, and for modifications in compositions due to the inclusion of additional ingredients. These short-term patents would be cheaper than the protection now granted.

Fermentation of cane juice was prevented for 24 hours by 0·01 per cent. and for 48 hours by 0·05 per cent. of sodium benzoate. But though fermentation could be delayed for one month by 0·11 per cent. and even longer by 0·14 per cent., the juices were bitter, and the glucose content had increased from 0·9 to 2·6 per cent.[2]

In Germany (at the Leuna plant of the I. G. Farbenindustrie A.-G.) sulphur is being obtained from the sulphide gases abstracted from town gas.[3] This is done by separating the sulphide gases by means of activated carbon, which is later treated with ammonium sulphide solution, the polysulphides therein being decomposed with superheated steam. About 95 per cent. of the sulphur originally present in the gases is thus recovered.

Factories of the Great Western Sugar Co., Colorado, have almost universally adopted electric welding.[4] This machine, economical and rapid in action, has many uses, covering a wider field than the acetylene torch. It builds up pump shafts and worn house shaftings, pitted steel sheets, knife box backs, and roller table knobs. A leaking battery or pan tank, for instance, can be repaired easily, and even cast-iron can be welded by the use of steel studs.

During 1926-27 about two million bags of Philippine sugars were melted in the American refineries, of which quantity about 61 per cent. was classified as "satisfactory" by the Consulting Refiner, Mr. H. E. NIESE,[5] and the rest as "poor." This classification relates mainly to the filtration rate, which in the laboratory is determined by means of the ELLIOT apparatus. On the whole Philippine sugars are regarded by the refiners as inferior to Cuban.

Examining cane molasses with the view to its utilization for yeast production in Germany, H. CLAASSEN[6] points out that the non-sugars of significance for this purpose occur in smaller amount, and are of a different nature compared with beet molasses. Java molasses contains 14-15 per cent. of organic non-sugars and 0·33 per cent. of nitrogen, the former being only $\frac{2}{3}$ to $\frac{3}{4}$, and the latter $\frac{1}{5}$ to $\frac{1}{6}$ that of beet molasses. Only a small proportion of the nitrogen is assimilable by the yeast during its propagation. Its value consists in its content of total sugars (about 54 per cent.), but its *pH* is not so easily regulated, being poorer in buffers. Its price, however, is only 11 Mk., compared with 18 Mk. for the beet by-product.

A very pure form of wrought-iron is known to be very resistant against corrosion, and in the Philippines may be seen buildings sheathed with iron, 30 or 40 years old, unpainted, and in no need of such protection to-day. In 1914 five evaporator cells of a mill in Hawaii were equipped with tube-sheets of pure iron, and after continuous service since that date are now found to be in good condition. Solid copper tubes and steel pipes may under like conditions of service be eaten through within two seasons. Grooves were however observed encircling the tube holes, these being caused by the electromotive relationship set up by the contact between the iron and copper or brass tubes. Pure iron parts have the further advantage over brass or copper in that they can be replaced and built up indefinitely.[7]

---

[1] *The Chemical Trade Journal*, November 9th, 1928.
[2] A. S. ALVAREZ. *Rev. ind. agr. Tucuman*, 18, 35-37. [3] *Chemical Trade Journal*, 1928, 83, No. 2167, 478.
[4] *Sugar Press*, 1928, 12, No. 7, 9-10. [5] S. D. LABAYEN in *Sugar News*, 1928, 9, No. 9, 641.
[6] *Zeitsch. Ver. deut. Zuckerind.*, 1928, 383-384. [7] *Facts about Sugar*, 1928, 809.

According to a patent recently taken out by the Petroleum Products Refining Company,[1] sugar juice (at a density of 1·263 to 1·383) is treated for its bleaching and purification with nitrogen peroxide under the influence of an electric current, then with a stream of hydrogen, and, after filtration, with a high tension electric current.

In experiments on frothing during carbonation in the beet factory, VL. STANEK and J. VONDRAK[2] found good results to be given by certain oily and fatty preparations. They point out, however, that the addition should be in extremely small amount : viz., 0·05 mgrms. per 0·25 litre of juice, or 0·02 kg. per 1000 quintals of roots. If the amount used is increased beyond this limit, the results are less efficacious.

Filter-press cake has been found in Java to have only a very limited value as a fertilizer, says Dr. PH. VAN HARREVELD. Attempts to use the cake from sulphitation and carbonatation factories may be said to have failed. Defecation factory mud, which has a nitrogen content averaging less than 1 per cent., and a phosphate content which generally is negligible, being anyway only very slowly available, has been successful only on dry coarse sandy soil, and on poor heavy soils, the physical properties of which it improves.

As will be seen from a reference to our advertising columns, DE VECCHIS (Foreign & Colonial) LTD., are giving notice that they have lodged with the Comptroller of the Patent Office, London, an application for the revocation of Patent No. 285,115, the principal patent of the Oxford Process of Sugar Beet & Crop Driers Ltd. Meantime the De Vecchis Co. state that they will take action, in every country where they hold the rights of the De Vecchis process, for any infringement of their patent by any one using the so-called Oxford Process.

Alcohol has hitherto been "solidified" by means of soaps to which stearin, sodium silicate, shellac, nitrocellulose, etc., etc., were added. Such preparations can be used for combustion purposes only. But in a new process[3] ethyl alcohol gels, rich in alcohol, can be produced successfully by the simple solution of certain solidifying materials in boiling alcohol or by the addition of a concentrated aqueous solution of these substances to the alcohol. The colourless preparations thus obtained are completely soluble in water and have neither taste nor smell. As hardening substances, the alkali or alkaline earth salts of the sulphuric acid semi-esters of acetone derivatives of sugars and of polyatomic alcohols, as, for example, of diacetone glucose, acetone galactose, diacetone fructose, and acetone glycerol, are used. The potassium salt of a-diacetone fructose sulphuric acid proved especially suitable. Such preparations are suitable for consumption, especially for the production of alcoholic medicaments in solid form, besides having other purposes, for making cosmetics, for example. At present the process is dear, but it is expected that with a demand before them the manufacturers will be able to reduce costs.

Artificial fertilizers now being made in Germany on a very large scale, "Nitrophoska" for example, differ from previous mixed fertilizers in that they are not obtained by simple mixing of the constituents but by means of chemical transpositions, and hence they contain the constituents in most intimate admixture. "Nitrophoska" is produced by adding diammonium phosphate and a high-grade (over 50 per cent. K_2O) potassium chloride (or potassium sulphate) to ammonium nitrate. It is essentially a ternary mixture of potassium nitrate, ammonium chloride, and ammonium phosphate, and appears on the market in the well-known different forms (with nitrogen, potassium, or phosphorus stressed). Instead of ammonium phosphate, dicalcium phosphate is said to be used in certain cases, and a complete fertilizer, "Harnstoff-Kali-Phosphor," is produced as well. This is entirely free from non-fertilizing components. "Leunaphos" is described as "the latest discovery in fertilizers for sugar crops." It is a salt mixture of sulphate of ammonia and di-ammonium phosphate. It contains 20 per cent. of ammoniacal nitrogen and 20 per cent. of phosphoric acid, of which 18·4 per cent. is water-soluble. It is finely grained, and in good condition for broadcasting over the soil, and is not hygroscopic.

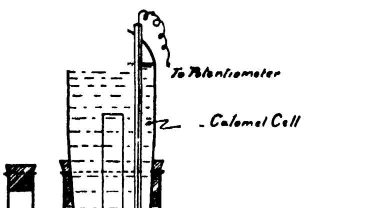
---

[1] *French Patent*, 618,779. [2] *Zeitsch. Zuckerind, Czechoslov.*, 1928, 53, No. 7, 81-98.
[3] *German Patent*, 461,308 in the names of HEINZ OHLE and JOHANNA OTHMAR-NEUSCHELLER, of Berlin.

Review of Current Technical Literature.[1]

Automatic Control of Carbonation and of Sulphitation using an Electrometric *pH* Apparatus. R. T. Balch and J. C. Keane. *Paper presented to the Division of Sugar Chemistry at the 76th Annual Meeting of the American Chemical Society, September,* 1928 ; *Industrial and Engineering Chemistry,* 1928, **20,** No. 11, 1148-1151.

Automatic control of the second carbonatation process in the manufacture of beet sugar, based on the *pH* of juice, has been shown to be practicable. It functions on electrometric principles whereby the e.m.f. produced between tungsten and calomel electrodes immersed in the juice (which varies in proportion to the *pH* of the juice) causes the electric motor connected to the gas valve to operate directly through a system of relays. Following is a description of the equipment used : The electrodes were (1) the usual standard saturated calomel half cell, contact with the juice being made through a porous cup filled with potassium chloride, constituting the salt bridge, and (2) the bare tungsten wire electrode. The electrodes were suitably arranged in a glass flow chamber (see figure) through which a continuous sample of juice was passed over the tungsten electrodes and salt bridge. A temperature compensator, the purpose of which was to correct automatically for the changes in *pH* caused by temperature fluctuations, was also inserted in the flow chamber.



The recording potentiometer with controlling device is an adaptation of an instrument that has been on the market for a number of years. The recent developments, experimental in character, include the arrangement for temperature compensation of the recorded values and improved means for controlling the reversing motor which operates, in this instance, the gas valve. The control used in this investigation is termed the "anticipatory" type (in contrast to the "intermittent" type used by Balch and Paine[2] in their study of automatic control of cane juice defecation) which acts in such a manner that the gas valve is gradually opened when the reaction of the solution is above the desired *pH* and still going higher, and is gradually closed when the *pH* is too low and still going lower. The mechanism for producing a control of this type consists of a mercury switch containing four contacts in series with the contacts of two other switches, which are closed according to the direction the recording carriage is moving. The mercury switch is adjusted so as to be in a horizontal position when the reaction of the juice is at the desired *pH* value. The factory arrangement for gassing juice at the second carbonatation station was to allow the first press liquor to flow continuously into a double-compartment tank. In the first compartment the main portion of the gassing took place. After a certain level was reached, the juice overflowed into the second compartment and any further gassing required was accomplished here before the juice was pumped to the second presses. Improvement was made in the automatic control by taking the sample directly from the first compartment, thereby shortening the time lag, and doing all the gassing in the one tank. Since gravity flow was not possible, a small motor-driven centrifugal pump was used to circulate the juice from the tank through the cooling apparatus and cell containing the electrodes. To insure continuous operation and to obtain a strictly representative sample of juice, which is

[1] This Review is copyright, and no part of it may be reproduced without permission.—Editor, *I.S.J.*

[2] *I.S.J.*, 1928, 30, 431.

very important, an over-capacity pump was used and only a portion of the juice circulated by the pump was sent through the cell by means of a by-pass but with sufficient pressure to replace rapidly the juice in the cell. Also, the capacity of the cooling apparatus was designed to maintain a temperature of 30 to 35°C., even with a rapid circulation of juice. In view of the fact that the control of sulphitation processes, particularly of thin-juice going to the evaporators, is likewise of primary importance, the behaviour of the tungsten electrodes in this type of juice was also tested. An automatic control was not attempted owing to the variability in the composition and pressure of the sulphur dioxide-air mixture. The reaction of the juice was recorded, however, and the results obtained agreed very well with colorimetric and hydrogen electrode *pH* tests on the same material. This indicates, therefore, the possibility of utilizing similar equipment for an automatic control of sulphuring thin-juice, provided arrangements are made for delivering sulphur dioxide under more constant conditions than are ordinarily present.

BOILER FEED WATER IN HAWAIIAN CANE SUGAR FACTORIES: ITS MAKE-UP, AND ITS *pH*. **W. R. McAllep.** *Paper contributed to the Hawaiian Sugar Technologists' Association.* 1927.

Under average Hawaiian conditions, assuming that all the bagasse is burned and that 2½ lbs. of water are evaporated per lb. of fuel, about 1300 lbs. of steam will be produced per ton of cane. Losses through pressure relief valves, leaks, traps and oil separators in steam lines, venting heating apparatus, etc., vary greatly in different factories, but in most cases will probably be within the limits of 10 to 20 per cent. Roughly then some 130 to 260 lbs. of make-up water are required per ton of cane. Under the usual conditions the quantity of condensed vapour does not differ greatly from the total amount of steam generated. When the evaporator equipment consists of a quadruple effect, we may expect slightly less than the total amount of steam; say, 1200 lbs. per ton of cane. Maceration and filter-press requirements amount to about 800 lbs., leaving an excess of some 400 lbs. of hot water. Assuming a temperature of 170°F., the heat in this 400 lbs. of water is equivalent to between 2 and 3 per cent. of the total steam generated, and from the standpoint of heat economy, it is desirable to utilize this heat. Much of it can be saved by supplying boiler feed-water make-up requirements with this condensed vapour.[1] With but few exceptions, fresh water is used for make-up purposes in Hawaiian factories, a practice by no means free from undesirable features. Fresh water usually contains scale-forming constituents, suspended matter, or constituents liable to cause corrosion, and is always saturated with oxygen and carbon dioxide, two objectionable constituents, the removal of which requires boiling in an open feed-water heater. Further, when we use fresh water we lose the heat in an equivalent amount of hot condensed vapour which might be substituted for it. Condensed vapour on the other hand is distilled water and is practically free from scale-forming constituents. It is almost invariably alkaline. During factory inspections in the last two years 7·1 has been the lowest and 8·3 the highest *pH* found in condensed vapour, which *pH* values represent very small amounts of alkali, as the water is very lightly buffered. Condensed vapour is seldom entirely free from traces of sugar which decompose into acid products under conditions in the boilers. Its use in the boilers has not been looked on with favour because of severe corrosion that has taken place at times when this water has been used, though a few Hawaiian factories are using it as make-up. If fresh water be replaced with condensed vapour, we eliminate difficulties with scale, but the factor that must be guarded against is corrosion. In the writer's beet factory experience, no corrosion, except some due to oil, has taken place when the water in the boilers has been maintained at about 8·3 to 8·8 *pH*, and the same reaction should prevent corrosion under cane sugar factory conditions. Lime and soda are the most readily available materials for correcting acid conditions and both are permitted under the A.S.M.E. rules. As sodium carbonate is such a common constituent of boiler feed-waters and as it is

[1] Condensed vapour = condensates from the evaporation of juice; condensed steam = condensed steam generated in the boilers.

too soluble to form scale, we are accustomed to regard it as harmless, yet in the choice of a reagent for neutralizing acidity in boilers we should consider at least one of its undesirable characteristics. In a boiler, at 100 lbs. pressure about 50 per cent. of it is dissociated. At sufficiently high concentrations there is a considerable difference in potential between sodium hydroxide solutions and iron, and the resulting electrolytic action oxidizes steel rapidly. Water in the boiler itself does not become concentrated enough for this action, but imperfections between the plates or around rivets form capillary spaces, closed on the outside by the caulking, in which the sodium hydroxide does reach a sufficiently high concentration. If the steel is stressed beyond the yield point, a condition which is probably adjacent to improperly driven rivets or along seams if the plates are not perfectly rolled to shape, this type of corrosion etches deep cracks in the steel. This has been termed embrittlement. Whether or not this factor is of practical importance under sugar factory conditions in the T.H. would have to be determined by tests. No data on the *pH* of condensates in steam lines under cane sugar factory conditions are available at present. Lime can be used equally effectively as a neutralizing agent, without causing embrittlement. On the other hand, a sludge might be formed with attendant danger of scale formation, if excessive amounts of lime were required for neutralization, or if excessive amounts of saponifiable oil reached the boilers. But in general it is preferable to soda as a neutralizing agent when condensed vapour is used for make-up. Using condensed vapour as make-up will increase the amount of sugar, but if heating surfaces do not leak and entrainment is kept within suitable limits the corrosive effect of acid products resulting from such sugar as reaches the boilers under normal conditions can be prevented by neutralizing to an appropriate *pH*. Whether or not we use condensed vapour as make-up, sooner or later we can expect that the water in the boilers will be accidentally contaminated with excessive amounts of sugar, in which case we must rely on the time-honoured remedy of getting rid of the contaminated water. Even in this case, if the *pH* is not allowed to drop too low, excessive damage to the boilers themselves is improbable if they are washed out at the first opportunity. Oil in the boilers is not influenced by the source of the make-up and a large proportion of it can be removed by efficient separators in the exhaust steam lines; yet in many cases these separators do not remove as much of the oil as they should because the steam velocity through them is too high for efficient operation. This is a point that cannot be neglected if satisfactory results are to be secured; and another is keeping the traps in working order. The sludge from oil separators plugs up traps quite readily, and regular examination to see that they are operating properly will be well repaid.

APPLICATIONS OF KIESELGUHR IN JAVA: CHARACTERISTICS OF GOOD FILTRATION KIESELGUHR. **P. Honig and M. v. d. Kreke.** *Archief*, 1928, Mededeelingen, No. 20.

Among the several materials which have been proposed as filter-aids for sugar juices and syrups as paper-pulp, woodmeal, carbonaceous preparations and silicates, kieselguhr has acquired a prominent place; and the writers point out that there are three ways in which it may be applied to the sugar industry in Java: (1) *For the filtration of muddy juices*, when it is added to the subsidings from the last settling tanks, though it is possible also to add it directly to the raw juice and thus obtain a good clarification. It can also be added to syrup subsidings. As to the amount, this naturally varies widely, though in most cases 1 kg. per 1000 litres of juice generally effects a remarkable improvement. Further, it is desirable to heat the subsidings to about 90°C. previous to the filtration, and also to adjust their reaction to a *pH* of 7·4-7·6 by running in milk-of-lime. As is well known, the effect of the kieselguhr is mainly to impart to the press-cake a certain porosity, so as to improve the rate of filtration, and the better to sweeten off. One must not expect, however, too much from the claim regarding the ability of kieselguhr to adsorb non-sugars. (2) *For filtering remelted well washed sugars*, say to a liquor of 60-65° Brix, one would use up to 1 per cent. (of Brix solids) of kieselguhr, and the temperature of the remelt should not be above 85°C., while the *pH* should be adjusted by lime to about 7·0.

(3) *For the filtration of syrups*, when larger amounts of the aid are necessary, to get a useful effect, viz., 3 to 4 per cent. (of Brix solids), a result superior in respect of clarity to that obtained with ordinary cloth filtration without the application of the aid being obtained.

In the second part of the paper are some interesting remarks on the qualities which a good kieselguhr for sugar filtration should possess as exemplified by an examination of the following kinds : Filtercel, Hyflocel, a German and three Java grades, micro-photographs of which are given. In these pictures the first two look very good, both being similar as regards shape of diatoms, the third is hardly less superior, though the particles are different,the fourth is not so good, while the fifth and sixth appear to be quite inferior grades, the latter in particular showing much amorphous material, stated to be clay. Determinations of the size of the particles, as described by ARRHENIUS[1] of a superior (Hyflocel) and an inferior (the present worst local) grade, failed to indicate conclusive figures, the fractions in fact from 1·5 to 240 in both cases analysing about the same. This points to the necessity of making an experimental filtration test for deciding the suitability of one grade over another. Anyway, it is certain that the presence of clay adversely affects filtration. In addition to the physical examination of this material, the results of a chemical examination have much weight. One of the tests to be applied is to boil up for five minutes a mixture of the kieselguhr (5 per cent.) with 20° Brix sugar solution, and note the ash content of the latter. All the six samples were found to increase it. An examination of the ash for silica, iron and alumina and CaO is also useful. Other tests to be applied are the following : (1) Boil up the kieselguhr with 20 times its weight of 20 per cent. sugar solution for 5 min., filter, and note if the colour has increased. (2) Shake up 0·5 grm. with 15 c.c. of 3 per cent. sodium hydroxide at intervals during 24 hours, noting the colour of the filtrate at the end of that time, this being a test for the presence of humus substances. Not more than a light yellow colour should develop. (3) Boil up with 20 times its weight of 1 per cent. HCl, and test the filtrate for iron, CaO and SO_4. Only slight reactions should be indicated. A table giving the results of these and other analytical tests is presented. In this recapitulation the two American grades show up on the whole the best of the six.

A SIMPLIFIED CATAPHORIZER. **W. D. Horne.**[2] *Industrial and Engineering Chemistry*, 1928, **20**, No. 11, 1147.

A convenient cataphoresis apparatus, designed to meet ordinary requirements with simplicity of arrangement, has given such satisfaction during the past year that a description of it may be of help to others. The capillary tube consists of a flattened tube about 1 mm. in vertical cross section by about 6 mm. in the horizontal. The capillary portion is about 8 cm. long and enlarges at each end to a ground tapered tube in the form of a stopper about 1·5 cm. in diameter, intended to connect with elaborate glass apparatus containing reservoirs for the sugar solution to be passed through and tubes to hold the platinum electrodes. This necessitates a distance of about 40 cm. between the electrode terminals, a good deal of manipulation in making tests, and considerable difficulty in supporting the capillary tube and connexions. All these disadvantages have been eliminated by discarding the glass connexions and passing over each stopper end a short piece of heavy rubber tubing, which holds snugly an ordinary cork through which pass a glass tube of 2 mm. internal diameter and a platinum wire about 0·5 mm. in diameter. The glass tubes permit filling, rinsing and emptying the capillary tube for testing while the platinum wires convey the electric current from ten 22·5-volt dry-cell batteries connected in series. These wires can be approached easily to within about 12 cm. of each other, thus enhancing the migratory activities of the colloidal particles under observation. For illumination, an ordinary microscope with the Abbe substage condenser removed has placed on its stage a Leitz double cardioid condenser, which refracts the light from below into a cone so that it converges on the capillary tube above, affording proper ultra-microscopic illumination. A dark circle painted in the centre of the condenser furnishes the desired dark back ground for the brilliantly illuminated contents of the

---

[1] *Archief*, 1927, III, 201. [2] Of the Hershey Corporation, Cuba.

tube. As the capillary tube stands a few millimetres above the condenser, it is entirely clear of any contact with the microscope, which thus can be instantly withdrawn for other use, when needed. The source of illumination is an ordinary stereoptican incandescent lamp, whose light is intensified by allowing it to shine through a flat-bottomed nearly spherical litre flask of water. A few millilitres of hydrochloric acid will keep the water permanently bright. The two small glass tubes protruding from the corks are fitted to rubber tubes, one leading to a funnel supported above, and the other supplied with a pinchcock leading to a beaker below. Thus the whole charge of 100 ml. can be quickly passed through, after examination, for addition of more night blue for a succeeding test. The whole assemblage, except battery, is enclosed in a box with a glass-covered hinged top. It is held rigidly and permanently in place by two Bunsen clamps screwed into supports, which in turn are screwed to the table top. For convenience in checking, the battery is connected with the terminals by a two-way switch.

"WULFF" *pH* TESTER. *Communication to this Journal.* Use is made of coloured strips (25 mm. × 7 mm.) of gelatin or like material impregnated with an indicator. They are supplied in three ranges (2·6-5·0, 5·0-7·2 and 7·2-9·0), the strips changing colour according to the *pH* of the liquid in which they are immersed. After immersion for a certain time (1 min.), the strip of the range selected is washed with neutral water, and its colour compared with a series of standard strips supplied with the set. This "tester" therefore has the advantages of being independent of standard indicator solution prepared with buffers, of being capable of application to highly coloured solution (as molasses), and also of being rapidly and easily manipulated. Its cost complete is moderate.—DENSITY AND APPLICATION OF "SUMAPHOS" SOLUTIONS. *Communication to this Journal.* In using "Sumaphos" for the clarification of juices or syrups, any convenient density from 15 to 30°Bé. of the cream resulting from mixing the clarifier with water may be employed, but the mixture should be added immediately, otherwise the kieselguhr settles out, making it difficult to obtain homogeneity.

For	15°Bé.,	take	36	parts of "Sumaphos"	and 100	of water.
	20	,,	48	,,	180	,,
	25	,,	68	,,	100	,,
	30	,,	104	,,	100	,,

In sulphitation factories particularly well clarified juices can be obtained by liming and sulphiting simultaneously while at the same time adding a solution of "Sumaphos." The amount advised in this method of working is only ½ lb. per 100 gallons of raw juice, the rate of flow being adjusted so that the addition continues during the whole of the liming-sulphiting operation. Juices result which are much brighter and lighter in colour than are obtained ordinarily.—EFFECT OF MANURIAL TREATMENT ON THE QUALITY OF CANE JUICE AND GUR. **P. B. Sanyal.** *Agricultural Journal of India,* 1928, 23, Part IV, 277-286. It was found that superphosphate had the greatest influence (in the case of cane variety Co. 213) in producing juice with the highest purity and sucrose content through the period of growth; sulphate of potash also appeared to maintain a juice of high purity; organic nitrogen in the form of mustard cake gave the next best results, but sulphate of ammonia and cyanamide gave the lowest graphs for sucrose and purity and the highest for glucose. A comparison of the different *gurs* was substantially in agreement with those observed with juices. Juice clarified by HORNE's "super-defecation" method[1] gave superior *gur* the sale of which, in spite of a higher cost of manufacture, was more remunerative.—ACTIVATED CARBON. **J. T. Strachan.** *Chemistry and Industry,* 1928, 47, No. 46, 1203-1214. A general review of the application of activated carbon (e.g., "Norit") in the industries. In testing such materials 1 grm. of the carbon is boiled for a few minutes with 200 c.c. of molasses solution (2 grms. in 1000 c.c., plus 10 c.c. of buffer solution[2]), filtered, and the colour compared with that obtained with a standard carbon.

J. P. O.

---

[1] *I.S.J.*, 1924, 312, 443.

[2] Made by dissolving 15 grms. of sodium hydroxide in 500 c.c. of water, to which 130 c.c. of phosphoric acid (25 per cent. strength) has been added, the whole being made up to 1 litre.

Review of Recent Patents.[1]

UNITED KINGDOM.

LIXIVIATION OF BAGASSE IN MILLING (AND GENERALLY FOR EXTRACTING MATERIALS). **Nicolaas Nobel, of Haarlem, Holland. 298,501. July 4th, 1927.**

Claim is made for the process for continuously extracting substances from solid materials (e.g. sugar from bagasse), which consists in forcing at least the greater part of an extracting liquid to flow in a closed circuit, introducing the solid material into the liquid, causing the solid material to flow together by the force of the liquid through a course, and after the solid has travelled in the liquid through a part of the closed circuit the solid entirely is separated from the liquid which continues to circulate. A very effective embodiment of the circuit is attained by forming a part of the same as a sinuous conductor through which the flow of the liquid and the material is entirely or partly caused by hydrostatic and gravitational pressure differences. By passing through the different parts of the said conductor the gases contained by the material are compressed and expended.

FIG. 2

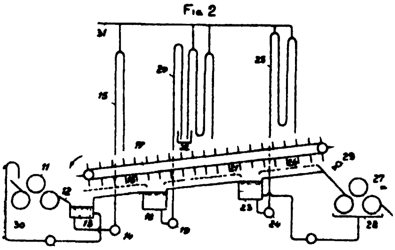
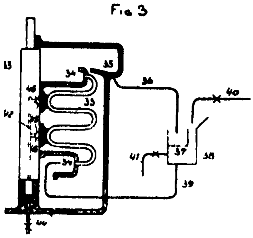


FIG. 3



The sinuous conductor may comprise syphons, as shown in Fig. 2. Here a three-roller mill is represented by 11. The bagasse from this mill moves over the fall plate 12 into the tank 13 containing cane juice. From this tank the bagasse together with the juice is pumped upwards by a pump 14 through a syphon 15, from which it falls on a sieve or strainer plate 16, where the separation takes place, the liquid returning to the receptacle 13, the bagasse being carried along by a rake carrier 17 till it falls into a tank 18. The juice within this tank contains lower sugar contents than the juice within the tank 13. From the tank 18 the juice and the bagasse are pumped through the syphons 20 by means of a pump 19, finally falling upon a sieve-plate 21, where again a separation is obtained, the liquid returning to the receptacle 18, the bagasse being conveyed by the rake carrier 17 till it falls in a third tank 23. A third washing out is executed by means of a pump 24 and a syphon 25 having two upward and two downward branches and the bagasse is finally carried along over the third strainer plate 26 towards the next mill 27. The juice, pressed out by this mill 27, is gathered in a tank 28 and pumped into the tank 23. The juice circulating in the system 23-24-25 is renewed by water or diluted juice supplied through a conduit 29 as far as the same is pressed out by the mill 27 and gathered in tank 28. The juice circulating in the system 18-19-20 is renewed by juice overflowing from the tank 23 and correspondingly the juice circulating in the system 13-14-15 is renewed by over-flowing juice from the tank 18. The excess liquid resulting from the supply of liquid through the conduit 29 is carried away from the tank 13 by a pump 30. This is the juice finally gained by the joint extractions in the three circulating systems and the pressing out from the mill 27; it may be used for imbibition before mill 11 by means of a conduit 30' or for other purposes. In Fig. 2 the syphon systems 15, 20 and 25 comprise different numbers of branches to make it definitely understood that the invention is not restricted to some particular number; the length and form of the tubes may be chosen at will in view of the desired pressure differences. As will be seen from Fig. 2, three closed circuits are

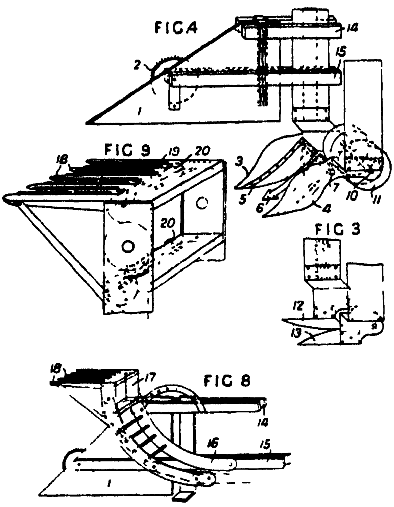
[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

represented diagrammatically, the first 13, 14, 15, 16, 13, the second 18, 19, 20, 21, 18, and the third 23, 24, 25, 26, 23, and thoughout these circuits the material and liquid are travelling towards the mill 27. The liquid of the third circuit is refreshed from 28, while the liquid of the second circuit is refreshed by liquid over-flowing from 23 along under the strainer plate 21, and the liquid of the first circuit from 18. Throughout the three circuits therefore a small percentage of the liquid is travelling towards the mill 11 or in a direction contrary to the path of the material. When materials are worked up, which contain a relatively great quantity of air or other gases, which would hinder proper action of the syphons, the upper parts of the syphon tubes may be placed in open tanks as shown at 32 or both these measures may be applied.

In Fig. 3 an apparatus is shown, where pressure differences are obtained by centrifugal force. In this figure only the right half of one apparatus showing a complete circulating system has been drawn. By using several of these, the countercurrent principle may be applied again. The apparatus comprises a rotatable tube system 33 rigidly connected to a shaft 33', driven by any suitable means. The tubes are arranged in such a manner that the fluid which passes through them from the bottom upwards continually moves towards the shaft and away from it again. The liquid is introduced into the tube system from the circular space 34, which rotates with it and leaves the system through the circular space 34'. The outlet has been placed at such a distance from the axis of rotation that lower pressure is created in those parts of the tubes which are closest to the shaft 33,' due to centrifugal force; in those parts which are farthest away from the shaft a smaller lower pressure or relatively higher pressure is created. These pressures may be regulated at will by changing the velocity of rotation and the distances to the axis of rotation of the various parts of the tube system and also by changing the positions of the inlet and outlet. The fluid flows from the circular space 24' into the circular room 35, from where it is carried off through a pipe 36. The separation of the material from the liquid is represented diagrammatically by the strainer 37. The material which is to be extracted is introduced into a tank 38, in which also is gathered the liquid dripping through the sieve 37. Liquid and material flow together through a conduit 39 to the circular space 34. The circulating extraction fluid is renewed from a conduit 40, in compensating whereof a certain quantity of liquid is drawn off through a conduit 41. This apparatus may be arranged in various ways, having in view that the fluid should flow through the apparatus in such a manner that its distance from the shaft alternately diminishes and lengthens.

Improvements in the Clarification of Sugar Solutions using Colloids. **G. E. van Nes,** of Semarang, Java. 297,430. September 19th, 1928; convention date, September 21st, 1927. In purifying aqueous sugar solutions a dissolved lyophyl colloid is added to the solution in which a coarsely dispersed precipitate is produced at a suitable temperature and hydrogen-ion concentration, so that the colloid is precipitated and can be separated, with colouring matters and other impurities, by filtration or decantation. Albumen, starch, amylum and silica are suitable colloids. The coarse precipitate may be formed by adding successively a base and an acid. In one example albumen is added to raw cane juice, which is then carbonated by means of lime and carbonic acid. In a second example, water-glass is added to diluted cane sugar molasses, which is then carbonated with lime and carbonic acid. Magnesia, baryta or aluminium oxide may be used instead of lime and sulphurous or phosphoric acid instead of carbonic acid.—Fodder from Sugar Factory Wastes. **C. N. Kjaergaard,** of Copenhagen, Denmark. 297,596. November 23rd, 1927. Organic waste materials that contain binding or adhesive substance, such as waste from breweries, sugar and canning factories or the stalks and roots of plants, are dried to such an extent that they do not contain more than about 16 per cent. of water and are then compressed at a pressure of about 350 atmospheres and heated to about 55°C. The materials form a solid cake that is held together by the binding or adhesive substance.—Crystallized Fruits. **B. Gernhardt,** of Berlin, Germany. 297,927. August 15th, 1927. Fruit is stewed with water in a closed vessel, and is then treated in the same vessel under high pressure of carbon dioxide

with a sugar solution containing 66 per cent. by weight of sugar formed by dissolving sugar in cold water. Apparatus for carrying out this process is described.—PRODUCTION OF ALCOHOL ACETONE, ETC., FROM CELLULOSE, ETC. **A. C. Thaysen, L. D. Galloway,** and **W. E. Bakes,** of Holton Heath, Dorset. 293,514. April 30th, 1927. Alcohol and acetone are produced from straw, grasses, etc., by subjecting the material to a preliminary hydrolysis with dilute acid, removing excess acid and steaming at atmospheric pressure, the carbohydrate mash being neutralized, inoculated with pentose fermenting micro-organisms such as the *Bacillus acetoethylicus* (Northrop), and the volatile products collected by distillation plant as described.—HARVESTING CANE. **J. J. M. Elias,** of The Hague, Holland. 294,152. July 17th, 1928; convention date, July 18th, 1927; not yet accepted. Canes are guided between two lateral dividers 1 having inclined upper edges from which upper edges rotary cutters 2 project to cut off stems lifted by and moving upwards along the dividers. Lifting members for the roots are situated between the dividers comprising coulters 3, 4 provided on their inner sides with inclined detachable guide plates 5, and also a hoeing blade 6 secured to a horizontal bar 7 attached to the coulters. A transverse shaft 10 arranged behind and above the bar 7 is fitted with a number of discs 11 to break up lumps of earth lifted by the lifting members. The coulters may be replaced by flat knives 12, 13, Fig. 3, when it is desired to cut off the cane below the surface instead of lifting the roots bodily. The harvesting appliance is adjustably mounted in a frame of girders 14, 15 adapted to be secured to the front of a motor tractor. The appliance may be combined with cover plates for the wheels or endless-track devices of the tractor or such cover plates may be fitted separately. The cover plates may be vertically adjustable. To bend over the cane and to cut off the tops a curved ladder 16 is secured to the front of the machine, its lower end being pivotally secured to the girders and its upper end to an adjustable frame 17 having a forwardly projecting comb 18 that is maintained horizontal. The frame 17 carries two sets of rotary saws 20 driven from the motor to cut off the tops engaged by the fingers of the comb, such fingers being provided with knife edges 19.—EXTRACTION OF SUGAR FROM DEHYDRATED BEET. **R. G. W. Farnell,** of London. 294,520. February 23rd, 1927. Beet in the form of cossettes or other divided state is dried before extraction at 100°C., or below, and at atmospheric pressure, the pressure while the material is in a heated condition being suddenly reduced to facilitate the subsequent diffusion process.—PREVENTION OF INCRUSTATION IN BOILERS, ETC. **H. Bardt,** of Schoneburg, Berlin. 294,656. July 28th, 1928; convention date, July 29th; not yet accepted. Deposition of scale in steam boilers, etc., is prevented by adding a mixture of activated carbon and a metallic powder such as copper, which is electro-negative to iron.—FERTILIZERS. **J. Y. Johnston, (I. G. Farbenindustrie A.-G.** of Frankfort-on-Main, Germany). 297,960. September 15th, 1927. Fertilizers are made by mixing potassium nitrate and di-ammonium phosphate together.—FILTER-PRESSES. **B. Gowshall,** of Burslem, Stoke-on-Trent. 298,282. July 12th, 1927. A distance-piece sliding in vertical channels on the movable head of the press is interposed between the head and the end of a central screw. The head is brought up to the frames of the press by turning handles on the screw, and the final pressure is applied by means of an internally-threaded worm-wheel, which engages the screw and is turned by a worm on a transverse shaft. The head is provided at each side with two rollers which travel on the side rails of the press.



UNITED STATES.

RECOVERING SUGAR FROM DEFECATION MUD. **Robert C. Campbell** (assignor to **United Filters Corporation,** of Hazleton, Pa., U.S.A.). 1,685,118. September 25th, 1928.

According to this invention, it is possible to continuously filter the muds from the first settling tanks without re-defecation, so as to produce a clear filtrate and reduce the sugar content easily to less than 1 per cent., while at the same time producing a partially dried mud or filter cake which may be conveniently conveyed around and added to the bagasse near the last mill and burned with the bagasse in the furnaces without returning it to the juice in process. The use of filter-cloth and the expense thereof is eliminated and less labour is required than in the older processes. In Fig. 1 is indicated a settling tank 1 for the first juices of a cane mill preferably of the continuous type and may be of the Dorr or any other desired form.

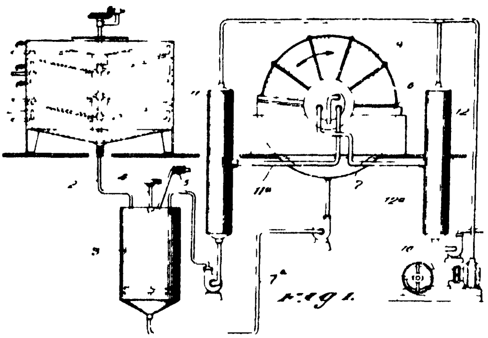


Fig. 1.

Clear juice from this tank overflowing near the top of each compartment is removed and conducted to the evaporators. Mud and settlings are withdrawn through pipe provided with a stirrer. In order to produce the consistency for proper filtration, the mud may be diluted by water from pipe 5 or by a portion of the filtrate. From the tank 3 the mud is pumped through pipe 7*a* to a filter 6 (of any preferred type provided with the inventor's improved filtering medium and adapted to operate continuously). In the illustration is shown the continuous suction type[1] and comprises a tank or tanks 7 for the filtrate, a rotating central shaft 8 carrying a plurality of filter leaves 9 adapted to rotate and dip into tank 7. Suction is communicated to each of the filter leaves through the central shaft 8 by means of vacuum pump 10, so that during the rotation of the leaves 9 through the tanks the fluid is drawn through the central shaft 8 and discharged into the tanks adapted to receive the filtrate, and a cake of the mud is deposited on the leaf. During a portion of the rotation of the leaves outside the tank 6, wash water may be sprayed on the filter cake and sucked through the filter to wash out the sugar or other values from the cake. The filtering medium applied to the leaves of this filter comprises a fine screen heavily rolled to produce smooth surfaces thereon or a perforated metallic plate having perforations of about 0·02 in. in diameter or width, and having as much of the area as practicable covered with these perforations, there being preferably about 600 or more per square inch, the exposed surface of the plate being smooth. After a short time, a cake of sufficient thickness and imperviousness is built up on the surface of the leaf to form an efficient filtering layer which produces a clear filtrate. During the first few seconds of the filtration, the muddy filtrate is run into a receiver 11 from which it is pumped back to the mixing tank 3, where it dilutes the mud from the clarifier, or to the clarifier 1, if a mixing tank is not used. As the filter leaves 9 enter the mud in the tanks 7, the suction from the pump 10, communicated to the receivers 11 and 12, draws the filtrate through the perforated plates on the leaves 9, and through the filtrate channels located around the central shaft to the valve 14 which automatically controls the discharge thereof. The operation of the filter is automatic. No disassembling and assembling is necessary as in the plate-and-frame type filters heretofore used, and the perforated plate filtering medium presents a smooth surface to the scrapers or cleaning devices and lasts indefinitely, wear on the surfaces of the plate by the scraping action being infinitesimal. A flow sheet (Fig. 7) is reproduced showing that the mud may go direct from the clarifiers to the filter

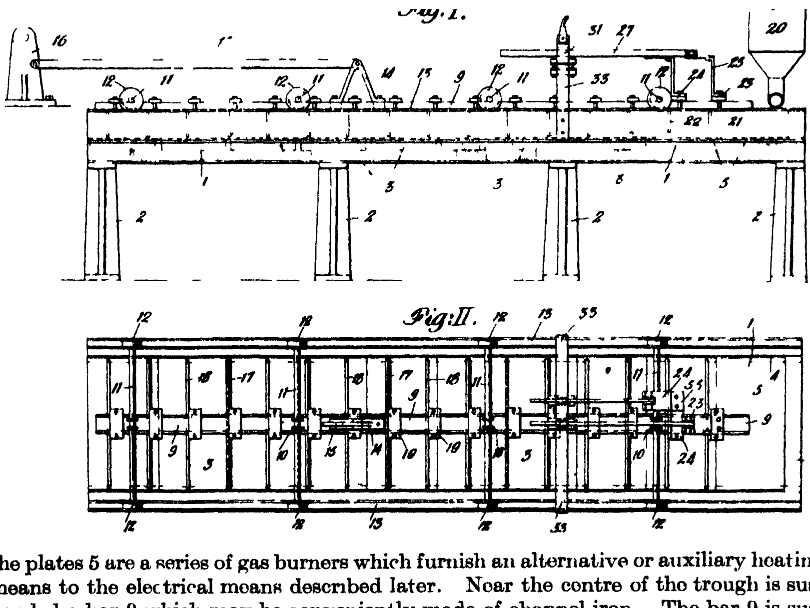
[1] The American Continuous Filter, U.S.P., 1,259 139.

and the muddy filtrate may be returned to the clarifier; while the clear filtrate may be returned through the clarifier to the evaporators and the filter-cake may be mixed with water before being placed on the bagasse or may be mixed with water and re-filtered to still further reduce the sugar content. Claim 1 reads as follows: The method of recovering sugar values from the muds separated from sugar juices which comprises continuously filtering the muds, continuously returning the cloudy portion of the filtrate to a previous point in the process, continuously collecting any remaining portion of the filtrate and continuously washing the filter cake and collecting the wash water, and completely cleaning the filter surface at each cycle of the filter operation.

—

ACTIVATION OR REVIVIFICATION OF CARBON. **Stanley A. W. Okell and Leonard Wickenden** (assignors to **Industrial Chemical Co.,** of New York, U.S.A.) 1,686,100. October 2nd, 1928.

According to the present invention, the particles of carbon to be activated are fed into a substantially horizontal trough-like apparatus in which they are exposed to the air at a suitable activating temperature, say 450° C. in a thin layer while being subjected to agitation brought about by means of a series of rakes which oscillate longitudinally in respect to the trough. Referring to the drawings: 1 represents a long shallow trough which may be made about 15 ft. long and 3 ft. wide. It is mounted at a convenient height on standards 2. The bottom of trough 1 is advantageously lined with water-cooled cast-iron plates 3, except near the feed end, and the sides with refractory material 4. Near the feed end of the trough the bottom is lined with cast-iron plates 5 which are not provided with water jackets like the plates 3. Beneath



the plates 5 are a series of gas burners which furnish an alternative or auxiliary heating means to the electrical means described later. Near the centre of the trough is suspended a bar 9 which may be conveniently made of channel iron. The bar 9 is suspended by iron straps 100 from a series of cross bars 11. The cross bars 11 are provided at either end with grooved wheels 12 which roll on tracks 13 on each side of the trough. A wish bone 14 extends upward from the bar 9 and is pivoted at the top to a link 15 which is connected to a suitable power mechanism such as crank 16 whereby the bar 9 is caused to reciprocate when the apparatus is in use. From the bar 9 are suspended a series of rakes 17 and 18 which are attached to the bar by clamps 19. The rakes 17 and 18 extend across the trough. The propelling rakes 17 are so shaped that the rakes tend to slide through the charge more or less on the back stroke

and to hold the charge more effectively on the front stroke. Thus the charge is gradually advanced through the trough. The charge, advantageously in a hot condition, is fed into the trough by means of the feed hopper 20, and tends to pile itself in a sloping mound at the feed end of the trough until it comes in contact with the electrode rakes 21 and 22, which are attached to the bar 9 by means of clamps 23 and 24 which are carefully insulated from the bar 9 by suitable insulating material. From clamp 23 and lateral extension of clamp 24, uprights connect horizontal bars which slide through slots, electric brushes, advantageously clamped upon a wicket, which bridges the trough, and carefully insulated from the wicket by strips of mica. These parts are made of material suitable for conducting electricity and are connected to each other and to a suitable source of electric current. The oscillating electrode rakes 21 and 22 are raised materially above the bottom of the trough so that the current passes through a substantial thickness of the carbon material from one rake to the cast iron bottom and thence through a similar thickness to the other electrode rake. If desired, the bottom plates 5 may be made of insulating material such as brick work, in which case the path of the current is through the charge from one electrode rake to the other. In this case it is not necessary to raise the rakes 21 and 22. The current is adjusted to heat the charge around the electrodes to a suitable activating temperature, such as 450°C. Once heated, the charge tends to maintain, or even increase, its heat as it passes through the trough, due to the partial oxidation or combustion of the charge. The average temperature of the mass is, therefore, regulated and the combustion limited by means of the cooling devices 3, the average temperature being gradually lowered to below the combustion point as the charge arrives at the discharge end of the trough. At the discharge end of the trough the charge falls off to the floor or to any suitable bin. For purpose of original activation an open trough (as illustrated) is generally advantageous. But when used for revivification purposes, it is frequently possible to activate the material with less combustion than will occur in the open trough. Hence, it is sometimes desirable to cover the trough in any suitable manner, to control the quantity of air admitted by dampers along the side of the trough and to provide a flue for the discharge of the products of combustion.

ON THE CLARIFICATION OF CANE MOLASSES. **Chas. Hoffman, Chas. N. Frey, and Frank M. Hindebrandt** (assignors to the **Fleischmann Co.**, of New York). 1,687,561. October 16th, 1928. In clarifying cane molasses for the growth of yeast, claim is made for the process comprised in adding a quantity of sodium silicate sufficient to render the resulting mixture alkaline with the limits represented by a *pH* value of from 7·7 to 12, then heating the mass and filtering while hot.—BEET TOPPING MACHINE. **James Mazzocco,** of Gallup, North Mexico, U.S.A. 1,687,730. October 16th, 1928. Claim is made in a beet topping machine for the combination of a main frame, a floating frame hinged at its rear end yieldingly supported for actuation through a vertical arc at its forward end by said main frame, a rotary knife carried by said floating frame and operable through a substantially horizontal plane and an altitudinally adjusting device comprising a series of spaced rotary elements depending from and adjustably connected to the forward end of said floating frame and adapted to travel in advance of said knife and also adapted to comb through the tops of standing beets in a field and contact and ride on the crowns thereof, said knife extending beneath said rotary elements.—SACCHARIFICATION OF CELLULOSE MATERIAL. **John Perl** (assignor to **M. M. Cory**, of San Diego, Cal., U.S.A.). 1,687,785. October 16th, 1928. Previous to the saccharification of cellulose bearing material by acid hydrolysis, the natural bases are neutralized with sulphuric acid.—ROTARY FILTER. **Walton C. Graham,** of Denver, Colo., U.S.A. 1,687,863. October 16th, 1928. A filter comprises a moving carrier, a trunioned filter tray movably mounted thereon, a filtering medium dividing the tray into upper and lower compartments, conduits connecting the trunnions of the tray with the two compartments respectively, and valve means adapted to connect the trunnion connected with the lower compartment, with suction means and to connect the other trunnion consecutively with a feed supply and a source of water supply during determinate periods in the movement of the carrier.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending December 31st.		Twelve Months ending December 31st	
*Unrefined Sugars.	1927. Tons.	1928. Tons.	1927. Tons.	1928. Tons.
Poland	....	18,665	6,454	22,813
Germany	....	....	4,320	460
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	247	1,208	21,282
Java	497	4,000	10,264	8,092
Philippine Islands	....	....	....	....
Cuba	36,069	33,134	356,146	702,780
Dutch Guiana	....	....	....	....
Hayti and San Domingo	....	280	137,767	208,359
Mexico	....	....	....	....
Peru	6,417	8,102	133,518	99,933
Brazil	4,801	1,967	40,543	18,000
Union of South Africa	6,380	17,365	43,887	71,440
Mauritius	20,725	26,057	192,565	188,675
Australia	30,027	35,381	83,328	150,604
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	9,972	5,533	92,296	138,620
Other Countries	2,451	9,595	74,624	79,116
Total Raw Sugars	**117,338**	**160,326**	**1,176,918**	**1,710,175**
*Refined Sugars.				
Poland	1,597	499	5,734	3,833
Germany	1,226	23	20,769	1,080
Netherlands	9,688	2,983	185,546	88,101
Belgium	810	156	9,325	3,818
France	....	....	....	....
Czecho-Slovakia	23,953	7,754	133,080	100,425
Java	....	....	....	....
United States of America	846	992	42,885	15,231
Canada	5	6	52,475	6,169
Other Countries	33	13	18,902	3,088
Total Refined Sugars	**38,158**	**12,426**	**468,716**	**221,745**
Molasses	37,147	15,401	144,904	219,345
Total Imports	**192,643**	**188,153**	**1,790,538**	**2,151,265**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	68	99	1,222	1,042
Netherlands	37	31	432	393
Irish Free State	3,466	4,766	52,089	48,996
Channel Islands	99	52	951	1,339
Canada	....	....	....	....
Other Countries	1,633	1,653	29,958	22,967
	5,303	6,601	84,652	74,738
Foreign & Colonial Sugars.				
Refined and Candy	161	182	3,721	9,825
Unrefined	68	47	1,999	923
Various Mixed in Bond	....	....	....	....
Molasses	73	472	348	4,343
Total Exports	**5,605**	**7,302**	**90,720**	**89,829**

*The corrected quantities and values of the Imports of Sugar are here given for 1926 and 1927.

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1928. Dec. 22nd. Tons.		1927. Dec. 28th. Tons.
Total Receipts, Jan. 1st to Dec. 22nd	2,900,668	..	3,021,813
Deliveries „ „	2,906,188	..	3,040,535
Meltings by Refiners „ „	2,812,915	..	3,000,398
Exports of Refined „ „	91,000	..	97,012
Importers' Stocks, Dec. 22nd	103,020	..	108,540
Total Stocks, Dec. 22nd	181,154	..	169,794
	1927.		1926.
Total Consumption for twelve months	5,297,050	..	5,671,335

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT NOVEMBER 30TH

(Tons of 2,240 lbs.)	1926. Tons.		1927. Tons.		1928. Tons
Exports	4,433,228	..	3,890,646	..	3,485,577
Stocks	225,593	..	344,693	..	287,347
	4,658,821	..	4,235,339	..	3,772,924
Local Consumption	145,000	..	146,000	..	63,004
Receipts at Ports to November 30th ..	4,803,821	..	4,381,339	..	3,835,928

Habana, November 30th, 1928. J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR TWELVE MONTHS ENDING DECEMBER 31ST, 1926, 1927, AND 1928.

IMPORTS.	1926. Tons.	1927 Tons.	1928. Tons.
Refined.. ...	698,949 ..	468,716 ..	221,745
Raw	1,066,128 ..	1,176,918 ..	1,710,175
Molasses .	150,126 .	144,904 ..	219,345
	1,915,203	1,790,538	2,151,265

EXPORTS (Foreign).	1926 Tons	1927 Tons	1928. Tons
Refined .	2,690 .	3,721 ..	9,825
Raw ..	1,212 ..	1,999 .	923
Molasses	2,288 .	348 .	4,343
	6,190	6,068	15,091

HOME CONSUMPTION OF IMPORTED SUGAR.

	1926 Tons		1927. Tons		1928. Tons
Refined	696,348	.	522,312	..	219,638
*Refined (in Bond) in the United Kingdom	788,022	..	880,040	..	336,423
†Raw	143,959	..	138,648	..	1,239,657
Total of Sugar	1,628,329		1,541,000		1,795,708
Molasses	6,106	..	6,048	..	8,069
Molasses, manufactured (in Bond) in United Kingdom ..	65,432	..	93,619	..	31,239
	1,699,867		1,640,667		1,835,016

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT DECEMBER 31ST.

	1926 Tons.		1927. Tons.		1928. Tons.
Manufactured from Home Grown Beet	24,850	..	48,800	..	66,700
Refined in Bond	54,500	..	68,050	..	6,950
Foreign Refined	106,250	..	24,250	..	13,250
„ Unrefined	176,350	..	121,700	.	180,000
	361,950		262,800		266,900

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from the 25th April, 1928.

† The quantities here shown include 97,072 tons entered for refining in refineries in the month ended 31st December, 1928, and 968,026 tons in the seven months ended 31st Dec., 1928.

United Kingdom Monthly Sugar Report.

Our last report was dated 9th December, 1928.

There is very little change to record in prices during the past month. The situation in the world is becoming much clearer, and although there is still no desire to go into stock, the general sentiment is veering round in favour of the article.

The White Terminal Market is becoming a very narrow one, and transactions are not so numerous. December was finally liquidated at 12s. 3d., and about 1500 tons had to be imported to finally impliment the contracts. March moved up to 12s. 8¼d., down to 12s. 2¼d. and up again to 12s. 6d., whilst May moved from 12s. 9¾d. to 12s. 3¾d. to 12s. 6¾d. and to 12s. 5¼d. August fell from 13s. 1½d. to 12s. 7½d.; December sold to 12s. 9d.

There was a far greater volume of business doing in the Raw Terminal section. March sold from 9s. 6¾d. to 9s. to 9s. 1½d., May from 9s. 9d. to 9s. to 9s. 2¼d., and August from 9s. 11¼d. to 9s. 3¾d. to 9s. 6d., whilst December fell from 10s. 1½d. to 9s. 7½d. and then moved to 9s. 9d.

The latest prices are as follows :—

	MARCH		MAY		AUGUST		DECEMBER
White..........	12s. 4½d.	..	12s. 5¼d.	..	12s. 7½d.	..	12s. 9d.
Raw	9s. 0¾d.	..	9s. 2¼d.	..	9s. 6d.	..	9s. 8¼d.

Dealings in actual sugar are still being confined to Home Grown and British Refined, and there was very little demand until after the New Year, when the trade again came in and bought their immediate requirements, but there was no sign of any forward buying. The Refiners made no change in their prices until the New Year, when they reduced them by 3d. on January 1st and then 6d. on January 3rd. Subsequently, however, they were advanced 3d. on January 7th, their latest prices being No. 1 Cubes 26s. 9d., London Granulated 23s. 10½d., the prices of Home Grown sugar varying from 23s. to 23s. 6d. (less the usual 4½d. rebate), according to factory.

Continental Granulated remains round about 12s. f.o.b. Dealings at the moment are confined to Dutch sugars as navigation on the Elbe is closed owing to ice.

Raws have been easier. The price has fallen as low as 9s. 7½d. c.i.f., at which level a fair business has been done.

The American market has been easier, and Raws at one time reached 2 cents c.i.f. New York. The latest price is 2$\frac{1}{32}$. The Futures market has fallen about six or seven points.

The Eastern markets have been steady, and the balance of the Java crop is now sold. Already the Trust have sold 600/700,000 tons of the next crop.

With regard to Europe, F. O. Licht again raised his estimate to 8,247,000 tons, against last year's actual out-turn of 8,040,719 tons. With regard to Cuba, the mills started to grind on the 1st January and estimates of the growing crop vary between 4,500,000 and 5,000,000 tons.

21, Mincing Lane,
London, E.C.3.
10th January, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 362. FEBRUARY, 1929. VOL. XXXI.

Notes and Comments.

Home Consumption of Imported Sugar, 1928.

The complete figures of the consumption of sugar in the United Kingdom for the last calendar year are not complete till the details of the consumption of home-grown sugar are known, and these are not available for analysis in our February issue. But as regards the bulk of the sugar consumed—that imported from overseas sources—the figures were given in our January issue on page 55. The total of Refined, Refined in Bond in U.K., and Raws amounted to 1,795,708 tons, as compared with 1,541,000 tons in 1927, and 1,628,329 tons in 1926. But Messrs. CZARNIKOW point out in their Circular that while consumption apparently shows a marked expansion over the previous year, it is no proof of real consumption, as the figures merely relate to duty-paid withdrawals and not to sugar actually absorbed. There has undoubtedly been a larger absorption of sugar in this country during 1928, but the official figures are somewhat misleading owing to the fact that duty is paid on raw sugar brought into the refineries, while no figures are available of the actual deliveries to distributors. The same statisticians point out that, since the Budget changes, exports of British Refined have been mostly drawn from stocks manufactured from duty-paid raws, although a small quantity has also been derived from pre-Budget stocks of "In Bond" refined; and it has therefore been necessary to deduct a certain proportion of these exports from the official returns of Raws "consumed" in order to arrive at a correct figure of consumption.

As regards the imports of sugar during 1928, the quantity was nearly 300,000 tons larger than in 1927 and about 165,000 more than in 1926. Raws, as compared with 1927, have increased by some 550,000 tons, though they only had some 8 months of the new Budget duties to stimulate them; but thanks to those Budget changes the receipts of imported refined have been more than halved, Holland showing a reduction of nearly 100,000 tons, and Czecho-Slovakia some 33,000 tons. On the other hand, there was an increase in imports of European Raws while Cuba just doubled her 1927 total, sending

us 715,526 tons—a figure more than three times what she sent in 1913. San Domingo sent 208,359 tons, as compared with 137,767 tons in 1927, while the British West Indies sent us some 46,000 tons more, and Australia 70,000 tons more, at 150,604 tons. The Mauritius quota was slightly the smallest for the three past years, while Peru sent about 33,000 tons less.

United States Consumption, 1928.

The consumption of sugar in the continental United States for the calendar year 1928 was 5,542,636 long tons, expressed in terms of refined. This compares with 5,297,050 tons in 1927, an increase of 245,586 tons or 4·64 per cent., as against an average increase over a period of 106 years of 5·114 per cent. The *per capita* consumption therefore works out at 104·27 lbs., as compared with 100·95 lbs. in 1927. The 1928 figures do not however equal those of 1926, the record year, when the consumption was 5,671,335 tons, equal to 109·30 lbs. per head, nor is the 1928 *per capita* figure as high as in 1925 when it was 107·50 lbs. But 1928 is the fourth consecutive year that the U.S. consumption has topped the five million ton mark.

According to WILLETT & GRAY, there are three important points noticed in 1928 consumption, the first being the large increase in the consumption of United States Beet, the increase ranging from 780,362 tons in 1927, to 1,037,241 tons in 1928. The second is the large increase in the consumption of White sugars that went directly into consumption. This class of sugar increased to 342,955 tons, compared with 135,130 tons the previous year. Thirdly was the important decrease in the total melt of all the regular United States refiners. This latter decrease totals 218,799 tons, but, as there was a slight increase in the consumption of refined sugar through San Francisco, the decrease in consumption is particularly applicable to refiners in the eastern and southern parts of the United States.

The margin between the prices of raw and refined sugars during 1928 worked out at 1·311 cent per lb. But in practice the refiners were not able to achieve this figure, because while they had to buy in advance of market changes in refined sugar, the latter was seldom sold in heavy volume at any given time. The refiners' actual margin is therefore said to be materially below the above average figure.

Co-operation in the British West Indies.

A Conference was held in Barbados in the latter half of January which marks, it is hoped, another stepping stone towards the Federation of the British West Indian Colonies. This latter desideratum is by no means in sight; many difficulties have yet to be overcome, some of them due to the scattered nature of these islands and the lack of speedy communication between them. Doubtless in course of time communication difficulties will be overcome when air transit is better developed and more reliable in its working. But in the meantime there are various ways by which much closer co-operation between the different island governments can be achieved. In 1926 Mr. AMERY, the Colonial Secretary, conferred with representatives of these colonies to consider the establishment of a standing conference to deal with matters of common interest, and the result was that the constitution of a West Indies Conference, to be held alternately in London and the West Indies, was drawn up and has since been accepted. The object of the Conference, it is pointed out, is not Federation; the functions of the conference are advisory and not executive, and such recommendations as are made at

it will not become effective until they have been confirmed by the respective Legislatures and received the approval of His Majesty's Government at home.

The Conference held in Barbados last month represents the first one of this new order; it was presided over, at the unanimous invitation of the Colonies concerned, by Sir EDWARD DAVSON, than whom it would be difficult to find a more competent head. The agenda dealt with covered a wide field. The sugar industry naturally received its share, and it was intended to discuss tariffs and preferences, and to urge that the preference in Great Britain on Colonial sugar should be increased so as to place it on a parity with the Canadian preference to West Indian sugar. Another question that received close attention was the one of co-ordinating the various agricultural interests and agricultural departments by means of the establishment of a Colonial Agricultural Service. At present each colony has its own agricultural department, which too frequently is not easily carried on for lack of funds or suitable facilities, and is apt to be sadly under-staffed. This proposed Colonial Agricultural Service was recommended as far back as 1927. To build it up and establish the much needed *liaison* between it and the several colonial departments, Mr. F. A. STOCKDALE has been appointed Assistant Agricultural Advisor to Mr. AMERY, and will get to work at once to re-organize West Indian agriculture on co-operative lines. In the end it is hoped that the number of departments will be reduced by amalgamations, even if the ideal of a single administrative agricultural service is not found possible in the immediate future.

Mauritius Sugar and the Budget.

According to an account in the *Mauritius Commercial Review*, Sir BENJAMIN MORGAN, Chairman of the Empire Producers' Organization, when he was in Durban last October, addressed a representative gathering of the South African Sugar Association, in the course of which speech reference was made to the policy of Mauritius in connexion with the efforts to meet the situation created by the new sugar duties in this country. Sir BENJAMIN said that they in this country fully recognized the peculiar position of Mauritius from the start. She makes nothing but white sugar and it would be unreasonable to expect that she should enter into a policy which would be detrimental to her interests. She has not committed herself to altering her methods at the present time. The refiners in Great Britain, when the bargain was brought about, fully realized the position of Mauritius, and while they would like to see her send raw sugars to this country and develop her industry in that direction, they were content for the moment to accept the position as it stood. He added that at a Council meeting of the Federation the refiners had affirmed that they would make preferential purchases of Empire sugar, and take preferential delivery of Empire sugar over foreign sugars.

But Sir BENJAMIN urged that the present reciprocal agreement between the Dominions and the Mother Country was spasmodic and unscientific. It should be taken out of the tariff in which it was inserted and be embodied in a reciprocal commercial agreement. This had already been done by us in connexion with other countries, and Canada had one with the West Indies. As a matter of fact, he said, negotiations for an exchange of preferences to take the whole matter out of the region of politics were going on to this end, and if successful should lead to an enormous development of the industry.

This same Mauritius paper prints a short argument on the incidence of the new sugar duties and points out that had our Empire sugar producers

been given sufficient fiscal encouragement to supply the deficiency of refined sugar on the English market, then their production would have been immediately stimulated; and increased production within the Empire invariably results in increased trade and employment in the United Kingdom. The sugar-producing centres of the Empire are far better customers for English products than countries like Cuba—and we might add, Santo Domingo—whence the bulk of the supplies of raw sugar for refining at home is now being drawn.

South African Affairs.

The crushing season that has just drawn to a close in Natal has proved a shorter one than the normal. This has been due to the prolonged drought; the rainfall of the year down to the middle of December was very low, being under 25 in., whereas in 1927 it was over 40 in. As a consequence lighter crops and inferior juice prevailed, only compensated by the greater capacity of the mills. The estimate of the total crop has fluctuated throughout the crushing season; at the commencement, in May, it was put at 287,000 short tons; in July at 270,000 tons, and in the end came out at 294,250 tons. The exportable surplus is estimated at 82,000 tons. Some 11,000 tons of Mozambique sugar are reported to have entered South Africa during 1928, in spite of the import duty of £8 per ton.

Amongst new cane varieties which are undergoing trial at the Natal Sugar Experiment Station are several POJ canes, including the well-known POJ 2878. A cane known as "1900 Seedling," which originated in Demerara and has high sucrose content and low fibre, is also being tried out. Badila is also thought to be a good cane given irrigation facilities. But the view of the Station is apparently that it is better to wait till the new POJ canes are established and can be supplied, than to distribute canes like Badila and "1900 Seedling" which while probably equally rich in sucrose are much more seriously affected by mosaic disease.

West Indian Crop Reports.

The following are the gist of Barclay's Bank Reports on the West Indies the last few months. BARBADOS: By September the canefields had, thanks to some rain, made a satisfactory recovery from the great heat of the summer; but the rainfall was deficient till in November when abundant rains fell, exceeding all records for the past 30 years. Most of the estates expected an average crop for the coming season; since the heavy rain came, the canes have made rapid growth, and the latest indications suggest that the yield will be a very good one. It is hoped that increased tonnage will to a certain extent offset the present low prices. TRINIDAD: The 1929 growing crop presents a healthy appearance, but it is feared that a reduction in the earlier estimates must be looked for owing to a shortage of rain to mid-September; subsequent to that date rains were abundant save in the south of the island. Much valuable work continues to be done in eradicating the froghopper pest, and the damage caused by it of late is understood to be almost negligible. JAMAICA experienced very favourable weather in summer and early autumn and was fortunate in escaping the severe West Indian hurricane of September; rain was somewhat deficient later, but at the beginning of December was again abundant. The banana crop of 1928 is expected to be one-sixth less than in 1927; high winds in November destroyed some 750,000 banana trees. LEEWARD ISLANDS: These islands felt the full force of the hurricane of

September. In Antigua a rough estimate of the total damage is put at £30,000; fortunately the growing cane was not high enough to be affected materially. In St. Kitts estate buildings suffered very badly, and taking the island as a whole the loss in cane has been put at between 20 and 30 per cent. The latest advices are, however, that in both islands the cane cultivation is recovering excellently. The coming sugar crop is certain to be short, but the reduction in output may prove in the end less than earlier estimated. BRITISH GUIANA : The weather was favourable at the beginning of the past quarter, and a good yield was expected from the end-year crop. The production for 1928 was expected to be over 100,000 tons of sugar. But the favourable harvesting season proved too dry in the end, and a quantity of canes have had to be carried over into the 1929 season. In December rain was becoming urgently needed.

The British Parasite Zoo.

An interesting letter recently appeared in the *Times* from the Chairman of the Research Grants Committee of the Empire Marketing Board, detailing the work accomplished in the past year by the newly started laboratory in this country for breeding beneficial parasites, as established by the Empire Marketing Board and under the control of the Imperial Bureau of Entomology.

No specific mention is made of sugar cane pest parasites, probably because other more urgent claims have received prior attention ; but it may be assumed that this branch of parasitism is not being neglected. The instances given of what is described as scientific team work within the Empire are nevertheless worth a brief recapitulation here, as the same principles will be applicable in dealing with the pests of the sugar industry.

Consignments of insects have already been sent out in response to requests from Canada, New Zealand, Australia, South Africa, Kenya, amongst other places. Thus between 20,000 and 30,000 larvae of a pine tree pest infected with parasites were sent to Canada. Ontario received 20,000 parasites of the greenhouse white fly ; and Vancouver received adult parasites of a scale insect that attacks fruit, those being sent over in small sealed test-tubes and provided with raisins for nourishment in transit. New Zealand has received a supply of Rhyssa larvae, the parasite of the destructive wood wasp, Sirex, which infests most timber-growing countries ; and both Australia and New Zealand have received some 30,000 larvae of the pear slug infected with three species of parasites, collected mainly from northern France. Meantime hundreds of thousands of sheep blow-fly maggots with their appropriate parasites are being bred in the laboratories, and some have already been exported in the chrysalis stage to Australia and South Africa. Other recent exports include parasites of the apple woolly aphis and of the earwig. Among the parasites in view are those to combat the apple codling moth and also one to deal with a troublesome weed, St. John's Wort ; then Dr. MYERS, of the Farnham Royal staff, has gone to the West Indies to deal with tropical parasites, and he will organize shipments of beneficial insects between the various islands and British Guiana. Finally, the possibilities are being explored of conveying a parasite of the Pink Boll Worm from the Sudan to Barbados, viâ Farnham Royal laboratory. These multifarious achievements show the comprehensive nature of the work of this parasite zoo and hold out much promise of a successful campaign being in course of time waged against some of the worst tropical and semi-tropical pests that at present ravage the work of the agriculturist and the animal breeder everywhere.

Tractor Sales in Java.

According to an American Consular report, conditions in the Dutch East Indies appear to be more favourable for the heavy track-laying tractors than for other types. Immediately after the war a large shipment of light-wheel tractors of Canadian manufacture was imported, but these were found not to have sufficient power for the heavy work required of them on the large agricultural estates of the country. Progress is now being made with the sale of tracklaying machines of fairly heavy type. Various European manufacturers have endeavoured to develop a tractor market in this area, but without success. FOWLER cable-ploughing equipment has been sold to a limited extent, and appears to be the best known European equipment on the market for power ploughing. The French Citroen tractor is also represented, but is said to be much too light to be effective. But tractors are not extensively used in the Dutch East Indies for agricultural operations. In Java, in particular, where agricultural development is most extensive, few tractors are to be seen. Their operating costs are said to be comparatively high and the work required of them is exceptionally difficult. At present there is little incentive to invest in equipment so expensive as the type of tractor required for sugar cultivation when native labour can do the necessary work at a slightly lower cost per acre. Sugar lands require careful and extensive ditching before preparation for planting, and native labour is satisfactory for this work and for ploughing. The limited number of tractors that are owned by sugar estates are used for emergency situations and for hauling cane from the fields. Importers, however, are of the opinion that a market for a Diesel or semi-Diesel tractor might be developed, as fuel for this type is easily obtainable and is much cheaper than gasoline or kerosine. One of the chief objections of sugar estate managers to using tractors is the cost of fuel, and this could be largely dispelled if a Diesel-engined tractor were to be marketed.

The Italian Sugar Campaign.

During the year 1928-1929 some 112,000 hectares were cultivated in Italy with beets, and the total production of those is calculated to have reached 2,800,000 tons of roots (against 2,090,578 tons produced in the preceding campaign) or 25 tons per hectare, and showing an increase of about 24 per cent. The production of sugar is calculated at 340,000 tons, against 276,240 tons in 1927-28.

The greater part of the sowings were made this year between the 20th February and 10th March. Between March 13th and 20th a period of intensive cold attacked the beets when in the most delicate period of their development, thereby causing considerable damage, and 12,000 hectares had to be resown. To the damage from cold had to be added that of premature flowering, which took place with particular intensity in the province of Ferrara and in the Veneto. For the remainder of the Spring the weather was favourable and the state of the fields was very promising until the beginning of the summer. A pronounced dry spell, accompanied by excessive heat, that lasted uninterruptedly for three months, was the cause of a scanty harvest, notably below the normal, and resulting in an average of 25 tons per hectare instead of 30. The scantiness of the crop was, however, in part compensated through the exceptionally high yield in sugar, exceeding that of any recent years, and if the abundant rains of September had not caused a setback to the growth, averaging some three degrees, the higher yield would have compensated completely for the loss in weight caused by the excessive dryness of the summer.

Notes and Comments.

When considering the importations of sugar that have already taken place from August onwards, amounting in all to about 10,000 tons, and putting the home production at 340,000 tons, the present availability of sugar is seen to be sufficient to cover entirely the needs of Italy for the whole campaign of 1928-29. In 1929 the whole of the 350,000 tons necessary for the consumption is expected to be produced by the indigenous industry, sothe Italian Government has just raised the import duty from 24·75 lire to 36 lire gold per quintal.

The new contract arranged by the sugar factories offers several advantages. The price of the sugar from which is calculated the price to be paid for the beets, after deducting the refining allowance of 27 to 22 lire, shows an increase of about 0·50 lire per ton. The cultivator's percentage in the price of crystalline sugar has been raised from 55·5 to 56. When the average yield of the beets exceeds 14 polarimetric degrees, the consequential higher price of the sugar is found by determining a proportional increase in the price of the beets.

The Question of Standardization in Figure Punctuation.

A recent mistake which crept into our pages owing to a decimal point (in the form of a full stop) being overlooked unfortunately resulted in a figure ten times too high being printed. It is customary in some parts of the world (and even in this country in ordinary newspaper practice where decimal fractions are seldom employed) to denote the decimal by merely putting a point before the figure, and generally on the line like a full stop. If the point breaks off in the printing machine (a not impossible contingency), all trace of the decimal is lost. For this reason we think it is a pity that there is no international standard use of denoting decimals, and that the practice set in this country amongst technical and statistical journals of always preceding the decimal point by a cypher, whether the " point " is on the line or half way up, e.g., " 0.5 " or " 0·5 " is one that deserves more general adoption. The cypher ensures the eye grasping the presence of the fraction, especially where the point is weakly printed or fails to print at all. But the problem is complicated from the fact that certain European and Latin countries use the comma to denote the decimal point, and, incidentally, the full stop to denote thousands. On this basis a figure to three places of decimals would read like " 1,234 " which would almost certainly mislead a reader accustomed to other standards of punctuation. The differentiation might not matter much to those who are native to the custom, but as so much international literature is nowadays studied, an international standard seems a thing greatly to be desired.

British Sugar Beet Society.—The next annual luncheon of the British Sugar Beet Society will be held on March 7th at the Hotel Victoria, London, W.C.2, at which Lord Ernle will preside. The Speaker of the House of Commons, the Minister of Agriculture, and other influential supporters of the industry will be present. Further information can be obtained from the Secretary at 28, Westminster Palace Gardens, S.W.1.

Refinery in Jamaica.—According to the *Times*, the British Suchar Processes Ltd., who are considering the establishment of a sugar refinery in Jamaica, have approached the island government for some assurance that no excise would be levied on refined sugar produced by the concern in Jamaica for a period of 20 years, and that all machinery, building, and other materials necessary for the erection of the refinery will be allowed to enter free of duty. The Governor favours the project, seeing that it would afford a certain market for a portion of the sugar crop and also provide continuous employment for Jamaican labour.

[1] *I.S.J.*, 1909, 334. [2] *I.S.J.*, 1926, 560. [3] *I.S.J.*, 1910, 423. [4] *Archief*, 1927, **35**, 709.

Home Beet Sugar News.

The Ministry of Agriculture states that the areas from which the English beet sugar factories will be ready to take supplies of sugar beets in 1929 and 1930 will be considerably extended. The movement is one which is calculated to assist the firm establishment of the industry in this country and to give farmers further afield a chance of sharing in the subsidy. There are at present 15 beet sugar companies now operating in Great Britain, who own between them 19 factories. A Committee representing 18 of these, called the Beet Sugar Factories Committee of Great Britain, has decided to consider the making of growers' contracts for 1929 and 1930 with any farmer in England and Wales who has suitable land for sugar beet, but whose farm is outside the present delivery areas of the factories. In such cases any cost over 8s. a ton of rail delivery to the factory will not be charged to growers; the factories will pay it, so that the Committee is going a considerable way to widen the sphere of the benefit coming from the sugar beet subsidy to the farming community generally.

But as the capacity of the existing factories is not unlimited, the new concession cannot be held open beyond that capacity, and preference must be given to existing growers and to growers within the existing areas. The scheme does not extend to Scotland and for its purpose England and Wales are divided into six areas, as follows : South and West of England, which will be worked from Salisbury ; the Midlands, with local office at Peterborough ; Monmouth and South Wales, with local office at Kidderminster ; Cheshire and North Wales, with local office at Allscott, Shropshire ; Lancashire, with local office at Kelham, Notts ; and the North of England with local office at Poppleton, Yorkshire.

The 1928-29 campaign in the country has, generally speaking, been a favourable one and several fine crops both in quality and quantity have been recorded amongst the ordinary run of returns, while it is not impossible that the total sugar produced may be near that of last year, although the acreage of beet grown was so much less. According to returns made to the Ministry of Agriculture, the total quantity of sugar produced to the end of December was 185,848 tons, as against 170,262 tons in 1927 to same date.

The process of adapting the existing beet sugar factories to refine raws in the off-season continues, thanks to the encouragement given them by the last Budget. Besides Cupar, which has been dealing successfully with raw Cuban sugar, and Colwick, which has already had one inter-season of refining, one learns that the Brigg factory of the Second Lincolnshire Beet Sugar Co. and the Selby factory of the Yorkshire Sugar Co. have made arrangements to instal the necessary machinery to carry on the refining of raws during the Spring and Summer. Brigg's coming refining capacity is said to be 250 tons of sugar per day. At Selby a sum of £36,000 is being expended on the necessary additions and improvements. Bardney, which is under the same management as Brigg, is pretty certain to follow suit before long, so that this year the contribution of the beet sugar industry to our output of refined sugar from overseas raws will be not inappreciable.

Sugar Beet & Crop Driers Ltd. are reported to be proceeding immediately with the equipment of a drying station at Norton Fitzwarren in Somersetshire for the drying under the Oxford Process of 25,000 tons of beet slices during the 1929 campaign. It is proposed at the start to send the dried cossettes to Eynsham for the sugar extraction process. Later on, if it is decided to add an extraction plant to the Norton Fitzwarren factory, this would prove a centre for one or two other drying stations, for example one in Cornwall.

Two British Beet Sugar Factories.

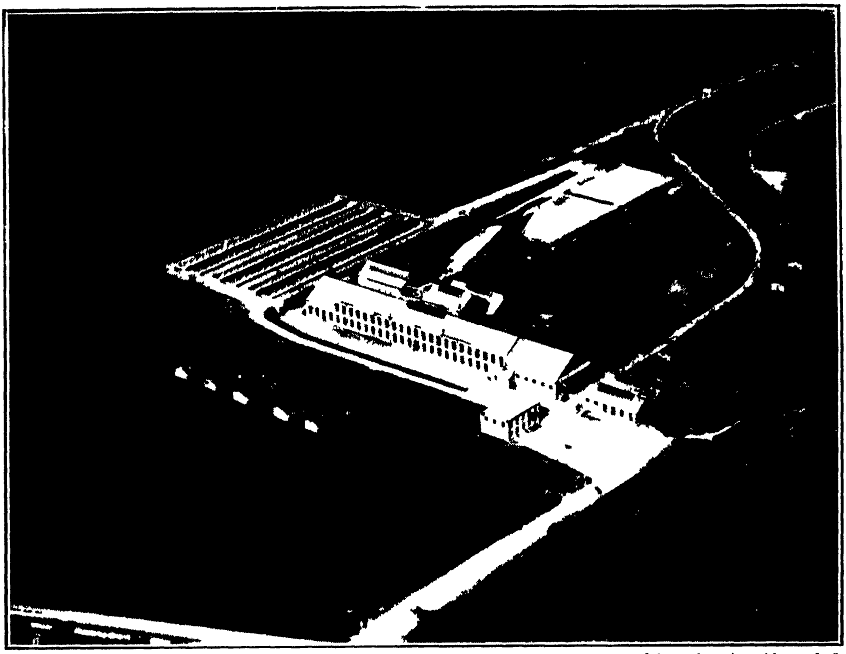


Photo by Aerofilms Ltd

Aerial View of the Kelham (Newark on Trent) Beet Sugar Factory of Home Grown Sugar Ltd.

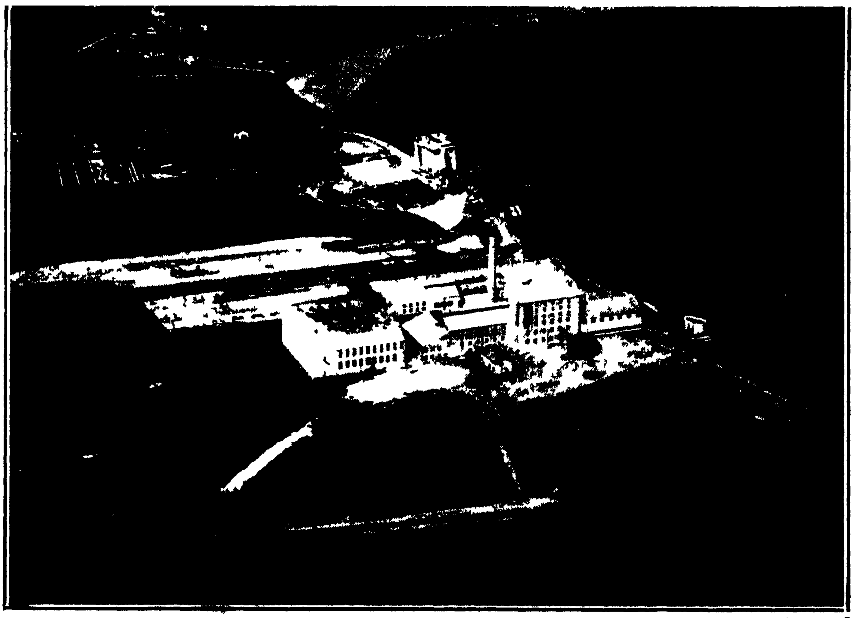
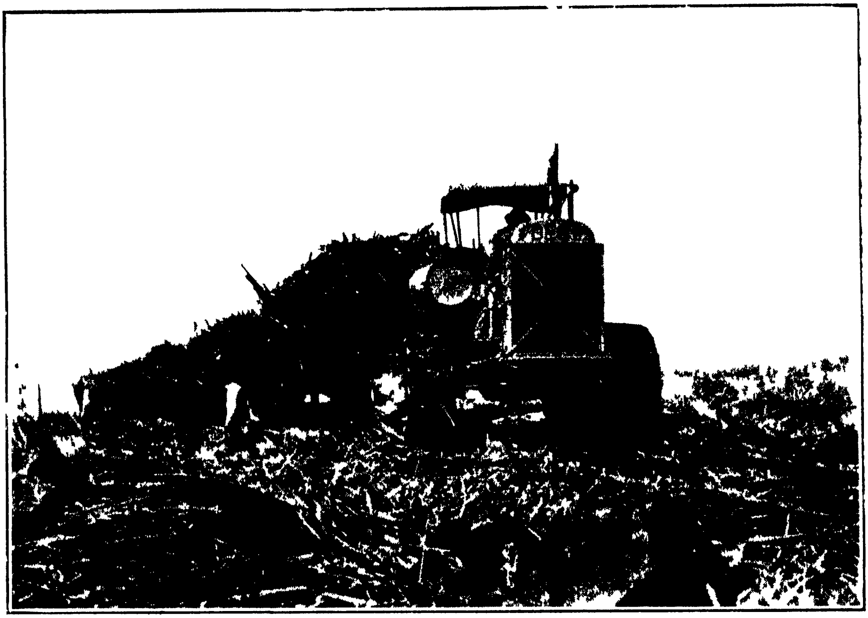


Photo by Aerofilms, Ltd

Aerial View of the Colwick Beet Factory of the Anglo-Scottish Beet Sugar Corporation, Ltd.

Methods of Cane Transport in Hawaii.



"Caterpillar" 60 H.P. Tractor used on Railroad Track to pull Trains of Cars loaded with Sugar Cane from Field to Factory in Hawaii

Hauling Sugar Cane in Hawaii with a "Caterpillar" Tractor

Scientific Sugar Cane Work in Hawaii, 1927-28.

The whole sugar cane world is, in these days, interested in the fundamental research being conducted in the Hawaiian Islands cane fields, where the guiding principle is the application of science to increasing production at a minimum of cost. Although, of course, the results obtained in the experiments are not generally applicable *en bloc* elsewhere, the methods employed and the intensiveness of the work may well serve as a model—within the limits of finance. It is not perhaps always realized how recent is this great wave of scientific study of the cane and its environment in Hawaii. A few years ago it was possible, for instance, to envisage the various projects of the experimental work within the limits of a moderately sized article ; but that time has now passed. There are not many experiment stations in Hawaii, considering the importance of the industry and the amount of research being done, and the most striking feature in the present stage is the wide extension of the scientific experiments among the planters who, after all, have themselves founded and endowed the research. This is a particularly healthy sign and obviously makes for stability ; it appears to be, in general, only where experiments are in an initial and relatively unimportant stage, or where they are of universal utility and require close scientific attention, that they are concentrated on local sub-stations, as for instance, in the early stages of cane breeding and the forestry sections.

The Report for 1927-1928[1] is a marvel of conciseness. In its 100 pages close on the same number of subjects are mentioned in the Table of Contents as being dealt with, and it would be easily possible to increase this number. As only plantation work is referred to in this review, one is grateful for the small alleviation of passing over the eight pages devoted to Technology. This conciseness, however, on occasion makes the perusal somewhat difficult ; but this is readily explained when we remember that the great bulk of the scientific work done in the cane industry in Hawaii is published in the *Planters' Record*, a private organ of the planters, not available to the outside world. To give a few instances : It would help us to understand a good deal if there were some intimation in what islands the various sub-stations are situated, and thus obtain some knowledge of the environment. Where are Manoa, Kailua, Waipio, Makiki ? These names do not occur in our lists of plantations. It is only after reading the report right through that we have come to the conclusion that all of these sub-stations are in Oahu. Then, here and there faults in headings add to the difficulties of the reviewer, e.g., does Waipio station include the Mid-Pacific Institute Project ? The Table on page 45, headed "Plant Food Tests—Quality Ratios," is by no means clear ; and we are quite at a loss to allocate the four columns of figures, which according to the context should refer to various experiments with nitrogen, phosphates and potash, or other different treatments. It is assumed that such difficulties would not be felt by the local planters, but a little latitude in the text would be of value to outside students. The report of the Director, H. P. Agee, is compressed into ten pages, in which the more important phases of the work of the staff are summarized. The subject matter of the remaining pages is divided up under the following headings : Entomology, Botany and Forestry, Agriculture, Chemistry, Technology, and Pathology. These are clearly separable and are in fact the Reports of the officers in charge of different sections. But a closer study of the work done umder these headings reveals that this subdivision is more a matter of local convenience than an accurate sub-division among the specialist officers concerned. And this irregularity leads on to an

[1] Report of Committee in charge of the Experiment Station, Hawaiian Sugar Planters' Association, for the year ending September 30th, 1928.

appreciation of what we may term the " key note " of the work being done in Hawaii. Thus, Agriculture is chiefly concerned with the botanical subject of cane breeding and the chemical work of manurial treatment of plots. Cultivation does not appear to be dealt with in the Report at all. It all shows that the scientific work in Hawaii has passed the bounds usually insisted on elsewhere. There is throughout a great development of co-operation between the plantations and the scientific specialists, as well as between the latter among themselves. It is recognized that any project must be studied from all points of view, and any one of importance becomes the subject of study in all of the different laboratories and on all plantations. The reports, then, of the various experimental stations are extremely brief, and they assume the character of the headquarters of the scientific officers rather than as the centres of their work, the latter being fundamentally on the plantations—a most desirable consummation.

Turning to the Agricultural Section, with which this article is chiefly concerned, the fact soon obtrudes itself that the growing period of the cane in Hawaii is unusually long ; with the result that experiments are in progress at any time on lots which have been planted in three separate years. While one set of experiments is being harvested, another is in full growth and a third is in its initial stages. Thus, during the period under review, 103 were harvested, 83 would be completed in 1929, and 77 had been laid down to be harvested in 1930. The experiments are almost all on plantations, and are distributed over all four islands ; and it appears from the lists given that the number of estates participating is gradually increasing. Naturally, in some experiments, only partial results were available at the time of writing the report, which is by J. A. VERRET.

An interesting *Cane Ripening* experiment was conducted " with the splendid co-operation of the Honolulu Plantation Company." All the data have not as yet been worked out, but the actual yields are reported. Ten plots were harvested, on each of seven dates between May 25 and August 27, irrigation being stopped on May 1. A Table gives the results obtained in yields and juice analysis. Apparently no great change took place in the weights of canes during the three months, but the juice purity showed a steady rise to July. The Q.R. (Quality ratio, which appears to indicate the number of tons of cane required to produce one ton of sugar) improved until the end of July, after which a steady decline set in. On those data the conclusion is drawn that, in this area, cropping in July would be most profitable.

Fundamental studies in *Cane Growth* were instituted at Waipio substation, under co-operation with the chemical section. Canes were planted so as to be harvested when varying from 3 to 30 months old, with 3-month intervals. The first six harvests are recorded. The plants were separated into green tops and leaves, dry trash, and millable canes, all of which were weighed and analysed for plant foods ; at the same time the soil was also analysed for the same elements. The cane weights alone were available for the first six periods. From 6 to 18 months, the tops and green leaves tended to remain constant ; the dry trash had not increased since the 15th month, and the millable cane had increased rapidly up to the same date.

Two experiments were made with *Molasses* fed to the canes in irrigation, one at Waipio and the other on Waialua plantation. The idea was that molasses, owing to its de-nitrifying power on soils, might hasten the ripening of the cane, when given at the last irrigation before harvest. The results were not very conclusive, but in both cases the purity of the juice from the

molasses plots was somewhat higher. For one thing, the harvest at Waialua was taken only six weeks after the application of the molasses, not leaving time for full action. The experiments are being continued to note the effect, if any, on the succeeding crop.

Nitrogen experiments were carried out in ten experiments on five estates, where ample phosphorus and potash were used, and the nitrogen applied in increments of about 50 lbs. per acre. The details are summarized in a Table in which the optimum amount of nitrogen to apply is the final figure. There was a wide fluctuation in the nitrogen response, the optimum varying from less than 100 lbs. per acre to 250. The conclusions drawn are (1) That in good fields and conditions it is perfectly safe to apply 200 lbs., and where very good between 200 and 250, greater amounts being limited as economic propositions, and requiring careful field tests. (2) On poorer fields, such as cold, acid mauka lands (upper elevations) the response drops below 200 lbs. and may be under 100. It is suggested that the safest general rule would be to apply nitrogen to these latter at the rate of 4 lbs. per ton of canes. Where yields are limited by lack of water, or low temperature, the addition of nitrogen would not improve matters beyond these limits.

The Effect of Nitrogen on the Juices was tested in nine experiments on five plantations, the amounts being given at 0 to 100 lbs. and beyond, increasing that by 50 lb. increments. From the quality ratios recorded in the Table the following conclusions are drawn. The lower applications between 100 and 150 lbs. has no injurious effect on the juice, while above this figure the juice will almost certainly suffer. In the latter case, the use of large quantities of nitrogen must be strictly governed by the economic balance between tonnage and purity.

The Phosphoric Acid experiments were conducted on similar lines to the nitrogen ones, in ten experiments on seven estates ; the increments varying from 25 to 100 lbs. per acre, starting from 1 to 400. There was a general response, especially in the mauka fields. The recommendation is that some phosphates should be given to all fields, in amounts ranging from 30 to 200 lbs. as indicated by soil analysis, field tests, and general experience.

Potash experiments were conducted on a larger scale, in 16 plots on 12 plantations, with a greater range of fertilizer, both in the usual amount given and in the increments ; and in the resulting optimum we note figures varying from 0 to 400, and in one case 1000 lbs. per acre. With all these three plant foods, the best practice should be based on the individual study of the soil types concerned. Reference is made to " a previous publication," in which it was shown that the cane plant uses a large amount of potash in its growth, even up to 500 lbs. per acre. Hence the importance is urged of not cutting down the potash application too low, for fear of rendering the cane weak and liable to disease attacks. Next follows the experiment on the *Effect of Phosphoric Acid and Potash on the Cane Juices,* whose Table has been noted as obscure to us. This experiment was conducted on ten plots on four estates, and four quality ratios are recorded in the Table for each experiment. The number of observations is admitted as too few, but it is " believed that there is evidence that on some types of soils potash affects the juice favourably."

In some of the islands, especially on coral areas, there is a good deal of *Chlorosis* in the canes, and experiments in spraying the plants with a 5 per cent. solution of iron sulphate effected a great improvement, as detailed in an article in the " Record," July, 1928. *Soaking Seed Canes* in a solution of lime and magnesium sulphate before planting was demonstrated in Porto Rico to give the best result in germination ; and these experiments were repeated

and extended to other chemical substances in Hawaii. Here the best results were obtained with a solution of ½ per cent. of iron sulphate.

The Report on the *Cane Seedling Work* by A. J. MANGELSDORF and C. J. LENNOX occupies eleven pages of small print. From it we draw the conclusion that there are a number of interesting points in which the Hawaiian procedure differs from that adopted elsewhere, not the least of which is the enormous number of seedlings which appear to be grown to maturity. This seedling work appears to be the main project in the islands at the present moment, and all of the sub-stations mentioned, excepting Waipio, seem to be chiefly devoted to it ; as well as, on occasion, all the officers of the department. A point of special interest is that the selection work is thrown upon the plantations. Once the crossings have been effected and the germinated seedlings are fit for potting up, they are distributed to the plantations, where they are grown to maturity and selected in due course. This method permits the large number dealt with although, in the opinion of the writers of the report, it is already time to issue a warning that they may be " swamped with a great accumulation of untested seedlings." Lists are given of the number of seedlings distributed during the current year to 21 estates, altogether 75,918 seedlings : 45,000 to Oahu, 12,000 to Maui, 18,000 to Hawaii, but none to Kauai " because of the large number of untested seedlings already in that island." There appears to be little or no selection among these seedlings before they are distributed to the planters.

The character of the breeding material has, naturally, received a good deal of attention, as the writers observe that previous work has largely depended on few parents " some of which were possibly rather closely related." But now a large collection has been got together at Kailua, where conditions have been observed to be specially favourable to arrowing. Through the Washington quarantine station, Chunnee and Kassoer seedlings have been added, and a large number of the difficult Yellow Caledonia seedlings have been obtained locally (5000), as well as some 900 Uba crosses. These, the writers claim, have added variety to the parental stock—we hesitate to fall in with the very free use of the term " blood lines."

The selection of seedlings is made on the estates to which they are distributed, in different Field Trials, presumably in successive years or longer generations. For Field Trial 1, the best time for selection appears to be rather difficult to determine, and is being investigated. It is obviously of advantage to have it as early as possible ; but if it is made, say, at ten months when each separate stool can be seen, the ability of the seedling to " carry over " will not have been proved. If, on the other hand, it is delayed till the canes would be normally matured, the field has become a tangled mass and the separation of the seedlings is an impossibility. To overcome this difficulty, several groups of seedlings are being graded at successive stages, as it should " in this way be possible to determine the relation between the selections at different ages and that for the final value of the seedling." No trouble appears to exist in selection in the later Field trials (presumably because the seedlings at this stage are set plants with less of the excessive vigour seen in sugar canes grown from seed, and especially where crossing has taken place).

A further list is given of the later trials being conducted in various plantations, when comparing seedlings with standard canes. But these trials are classified in a different manner. The writers urge the planters to initiate only such tests as will "determine the standing of the seedlings once for all " (extremely necessary advice if the great numbers are to be properly examined). The classification has this in view. " Trials with only one replicate or with

very small plots of each seedling are classed as preliminary, those with two to four plots as semi-final, and with five or more as final."

For comparison with standard canes, plots of seedlings are carefully laid out checker-board fashion with plots of the standard canes between; "as only by this method will the prompt recognition be obtained of mediocre canes to be discarded and superior ones to be tested further."

There are many further points of interest in this report, some of which invite comment, but such is impossible in the present article. Crossing technique is being developed with a main eye to increase of efficiency with a reduction of cost. The sulphurous acid treatment of male parents is the rule and this is being extended to female ones with a considerable amount of success; but an improvement has been suggested by HANCE, of using a mixture of sulphurous acid and nitrous acid, and preliminary experiments have shown this to be superior. Cutting off a joint of the cane used in these operations, once or twice a week, was found to be beneficial, while trimming the leaves was harmful. The question of selfing was gone into thoroughly, with the result that the writers consider that self sterility is the rule, and self fertility the exception, even in canes which produce pollen in abundance. The use of a new hand refractometer introduced by *ZEISS* has made it possible to form an opinion of the value of the juice of each of several thousand seedlings selected in Field Trial I. From an examination of some 2000 seedlings certain correlations were examined.[1] The following are the results; Quality ratio and tonnage show little or none; the two characters, vigour and good juice, are not necessarily antagonistic, and there is no pronounced tendency to mutual exclusion. Brix and purity show marked correlation, resulting in an extremely close correlation between Brix and Q.R.: lastly, both Brix and refractometer readings can be safely used as criteria of the quality of the juice, where complete analysis is impossible.

Attempts were made to induce mutations by the treatment of seedlings to sudden chilling and to X-rays. Thus far no success has been obtained, but arrangements are being made to treat next year a large number of seedlings at the same time, when newly germinated in boxes, after SADLER's method in Missouri, and thus to reduce expense. We note that the bud selection progeny trials at Waipio are to be harvested next year. We have heard very little about this project lately, and shall look forward to the results with interest. A comprehensive card index is being established of all seedlings under trial, as the writers "believe that the eventual recognition of the super canes among the seedlings will result mainly through an accumulation of information through many sources, rather than through the discovery of spectacular performance in an isolated instance."

The highly abbreviated Report of the *Chemistry Section* by G. R. STEWART is divided into Research and General Problems of Soil Fertility; but we find it, frankly, difficult to separate the latter from Research. The report embodies the soil studies proper being undertaken in Hawaii. These are of absorbing interest, often more so than many of those already mentioned in this review, but it is impossible to do more than indicate their character by one or two examples, however incomplete such a presentation may be.

The plantation surveys are steadily proceeding, and at the time the report was written were completed over the major portion of the companies which form the Association; but, besides and following this, more detailed studies were carried out on estates where special problems presented themselves.

[1] It is not stated whether these are of the same or of different parentages, which may be a matter of importance.

Root failure in various localities and with different cane varieties continued to absorb the entire time of several members of the staff. Some of the other pieces of work summarized are as follows : The nitrifying power of the Ewa soils, the sealing of pure water reservoirs by base replacement *versus* asphalt casing, the inter-action between the soil and fertilizers and the residual effect of the latter, the composition of H 109 with special regard to the adsorption of soil nutrients, soil experiments to reduce the nematode population, attempts at finding pure cultures to rear these (hitherto unsuccessful), the effect of irrigation on heavy soils, the effect of molasses on the absorption of toxic substances (e.g., Fe and Al), poor cane growth associated with replaceable sodium and magnesium, and the influence of the less essential elements on the growth of the cane plant (e.g., lead and boron).

The *Botany and Forestry* section, under H. L. LYON, pursues its unruffled way, in co-operation with the Board of Agriculture and Forestry of the United States, the army, numerous plantations, and private estates. The removal of stock from important watersheds, and adequately securing and fencing, are noteworthy signs of progress. During the year 157,636 trees were sent out from the main nursery, all of suitable size for planting out. There are four "Forestry Units," Halawa-Niulii (on Hawaii), Oahu, Hilo (Hawaii), and Kauai, in which separate projects are in operation ; while a variety of experimental work is being conducted at Manoa arboretum (Oahu). Valuable additions have been made to the collection during the year, from South America, Java and India. From the latter the *jalna* (*Terminalia myriocarpum*) has been introduced, and 25,000 seedlings raised. "The few specimens of the *jalna* obtained from seed introduced a few years ago have made remarkable showings under a wide range of conditions here in Hawaii, and we look upon this tree as one of the most desirable to employ in new forest plantings." The re-afforestation of the denuded watersheds of a country is a long and costly business, but the Hawaiian sugar planters who have so vital a stake in this matter are making remarkable progress,

Only a brief reference is possible to the Entomological and Pathological research in the Hawaiian cane fields, these sections being in the hands of G. H. SWEEZEY and C. W. CARPENTER respectively. The cane pests in the islands have, as is well known, been brought under control mainly by the importation of parasites from all parts of the world. This costly and intricate project, begun over a quarter of a century ago, is still being carried on, refinements and improvements being constantly added. But perhaps the most important piece of work during the year was the practical completion of a survey of nematodes in the soils in all plantations. These minute worms are of importance, not only because of the actual injury done to the tender cane roots, but also because they are suspected of assisting the entry of parasitic fungi through the lesions which they cause.

In the domain of cane diseases, attention was chiefly directed to the study of eye spot on the leaves and growth failure, owing to the diseased roots. And with respect to the latter C. W. CARPENTER has written a closely reasoned paper, in which he maintains his former theory that, in the Hawaiian islands at any rate, *Pythium aphanidermatum*, a minute parasitic fungus, plays the dominant rôle in the causation of root rot, more frequently termed root disease, with the consequent growth failure of different varieties of cane. This paper is worthy of careful consideration. The subject of growth failure is a major project, and is receiving attention by practically all the specialists in the department.

C. A. B.

Termites or White Ants.

A letter from Mr. F. M. KERR-JARRETT, of Montego Bay, Jamaica, has reached us, in which an interesting method is described of dealing with termites or white ants in the cane fields. The canes were D 1135 twelve months old and they were suffering from an attack. After various unsuccessful attempts to deal with them, an old cultivator advised strewing the ground with grated coconut, as this would entice the black, stinging ant which would quickly clear the patch of white ants. The result was a complete success. A further small infestation occurred at St. Catherine's Hill, but there the stinging ants were already in possession, and the outbreak came to nothing. Observations are further recorded on what appeared to be the normal procedure of these black ants. Apparently they patrolled in groups of three ; one acting as spy, another following as butcher, while a third acted as carrier and bore the carcase away.

This extremely interesting letter has called to mind the slumbering memories of past years. Having been located for 35 years in white ant countries, and always at heart a naturalist, the writer has noted many interesting things concerning them, but for the purpose of this article has fortified himself by glancing over two volumes on insect life in India, where termites abound both in numbers and in separate species.[1] In the following, information from these and other sources has been freely incorporated, and especially from the first named volume. Once interested, it has proved difficult rather to keep one's-self within moderate bounds than to find material ; and there may thus be a tendency to record the more striking and interesting facts in place of a sober scientific discussion.

In the first place it may be allowed that the naturalist sometimes tends to be rather soft-hearted towards the objects of his study. An occasion is recalled where, after a sudden downpour of rain in India, the whole compound was found to be covered with an immense number of large centipedes crawling in every direction. With a lively remembrance of the intense burning pain caused by their bite—a lighted cigarette placed on the tender parts of the body, and pressed in, and yet further in—execution commenced at once. But after some thirty were accounted for, without appreciably reducing their numbers, sanity prevailed. Here was this enormous population, evidently living in close proximity to the house, of which no single member had ever been met with before or done any harm (it was a large form with alternate blue and yellow segments often seen in other parts). The matter was left at that ; all had vanished the next day, and no trace of this centipede was ever met with again. The cobra will not strike unless it is cornered or trodden upon, and the dreaded scorpion will retreat, although with its tail lifted in menace ; and the termites, as will be seen take enormous pains to keep out of sight.

These latter generally have a bad character with folk returning from the tropics ; but considering their countless numbers, over a large part of dry India and Africa at least, it is surprising how little damage they do. As is generally known, the termites feed pre-eminently on dead matter, but there are many different kinds (perhaps some hundreds, of which FLETCHER states that there are forty to fifty species in Madras alone) and these vary in their food habits. Some will attack living plants including trees, others feed on dead wood and vegetable matter in general, some prefer the solid (half dead) wood of living trees, and yet others feed on grasses and lichens. In India, ground nuts, wheat and occasionally other cereals, safflower, and sugar cane are given as the principal crops which suffer from them. The

1 "Some South Indian Insects." T. B. FLETCHER, 1914, and "Indian Insect Life." H. M. LEFROY, 1909.

attacks on sugar cane are not very common, but the writer once observed a fine clump of canes somewhat suddenly wilting : and on investigation found the lower cane joints filled with white ant earth, the water channels round the rind being naturally left untouched till the last. It was a case of extremely bad after-cultivation and entry was probably through borer holes. But the *sets* newly planted, with their half-dead tissues, are specially attractive to termites. Of course the sets are not planted in dry ground, and reasonable irrigation usually keeps the termites at bay till the plant has gained sufficient size and strength to ignore them. Dipping the sets in preservative liquids is recommended, strong copper sulphate being specially efficaceous. Where irrigation is available and they are still troublesome, placing a bag of crude oil emulsion in the stream is also commended. But in the writer's experience proper after-cultivation is the best remedy ; the termites are a very intelligent folk, and hate to be disturbed, and moving the surface soil quickly drives them to lower levels.

The harm done to buildings and their contents is often very serious, and requires more attention ; but even here, at least one person, brought up in an atmosphere of camphor wood and metal clothes boxes, has suffered very little loss. Termites will not effect an entrance without very easy detection, provided the house has been properly constructed. Cemented ground floors (and the cement layer may be surprisingly thin), and properly placed bricks with no gaps between and perhaps a cement course low down the walls, are all that is needed. But if the structural wood used in building is not well seasoned, with ends placed in preservative, of course there is danger. Here a remembrance occurs of an estate house in Antigua, where a large central room had a series of fine beams across the ceiling. These were coated at intervals with a good layer of paint, and were apparently very substantial. But when certain reconstruction became necessary, they turned out to be completely eaten out, and only held together by the accumulated layers of paint.

Summing up, to an observer in India, where sugar cane cannot usually be grown without irrigation, the termite is not a serious menace in the field, while with ordinary precautions houses and their contents can very easily be protected. But on occasion, for instance, when out in tents or living in a badly built house, destruction is sometimes very rapid. Such a case is mentioned by LEFROY, where the whole of the bedding was removed in a Bengal prison in a single night while the inmates were asleep on it. It is, however, quite conceivable that, in countries with a "well distributed" rainfall and cane grown without irrigation, the termites may sometimes be much more destructive and difficult to deal with.

But they have their uses also, although these are less dramatic and, moreover, less easy to define. It always appeared to the writer that the commination and movement of the earth, so obvious in certain parts, with the network of underground channels, was bound to have a marked effect on the physical condition of the soil. He was accustomed to point this out in lectures in India, and even to compare their action with those of earthworms in temperate regions. Subsequently he found, however, that this was no new idea, but had been eloquently discussed by HENRY DRUMMOND in his book on "Tropical Africa," as long ago as 1896. If this is a true reading, the balance would seem to be weighted heavily in favour of the termite ! They are universal scavengers of any dried refuse, and wonderful cleaners up, though sometimes the dry stubble is wanted for incorporation in the soil. In places, they are an article of food valued by certain castes in India, and in Africa, being

available in specially large numbers when swarming. White ant earth is also a valued commodity, for manuring the fields by the natives of South Africa, and for making tennis courts everywhere in dry countries. Termites are excellent for poultry, and especially valued for young turkeys where these are difficult to rear. But these are minor uses compared with their probable action in keeping up fertility in the soil as referred to above.

It is, however, in their social development that the greatest surprises are met with ; for in the opinion of some they leave the ants, bees and wasps behind in this. They are *en masse* totally blind, no misfortune in their tunnels in the earth but a great drawback when they seek their vegetable food. Hence they rarely emerge without carefully constructing an earth-covered pathway, by dividing the soil into minute particles and cementing these together with their saliva ; thus all vegetation which they devour is covered by layers of fine earth, and their aerial pathways, so familiar to everyone, form closed-in tracks to the tops of high trees. On occasion, the earth excavated from their tunnels is built up into mounds (comparatively rare in south India), or peaks or miniature mountain ranges. And the surprising fact emerges that each species has its own architectural plan : they are wonderful architects, and the species is frequently easily determinable by the shape of its erections (as in the Bahr-el-Ghazal, according to SCHWEINFURT). Perhaps the East African species have the largest aerial structures, and DRUMMOND has some striking pictures of some of them. Quite recently the writer has seen a picture of a comfortable native hut, carved out of a "white ant hill."

Anyone in India wishing to see what termites are like has only to break a tunnel on a tree or building, when a vast commotion is seen among small, pale, ant-like insects, and almost immediately other larger forms appear flourishing a menacing pair of jaws, like small " earwig tails." These are the workers and the soldiers, both immature forms. The mature termites are best seen when swarming takes place. Out of a hole in the ground a constant stream of flying insects of a pale colour appear to be shot out. These alone are winged, and are the males and females designed to found a new colony when the parent nest is overcrowded. But deep in the heart of the settlement lies yet another form, the queen mother. No one would imagine that she was a termite : for she lies, an inert pale-coloured rather loathsome mass, sometimes as large as a man's finger, closely attended by a numerous body of workers with a sprinkling of soldiers acting as police, and also attended by a male as king. Her sole duty is egg-laying, and the ovaries may be seen in their convolutions under her semi-transparent, tightly stretched skin, with a constant stream of eggs passing along. She can rarely be found, for if she were, all problems of the white ant menace would be immediately solved : her removal would in all probability immediately dissolve the settlement.

Now, the workers, as their name implies, are the only ones who do any work, in the ordinary sense. And not the least of their duties is to obtain food for the development of the eggs. And the surprising thing is that it is very generally held that the workers, by appropriate feeding of the young, can alter the character of the form assumed when grown up.[1] But the other powers of these inconspicuous members of the crowd are still more astonishing. Like many of the leaf-cutting ants they are gardeners, and one species is often seen at Coimbatore, carrying bits of grass, leaves and stalks, as the ants

[1] FLETCHER records this fact for primitive races of termites, but did not find it to be the case with South Indian species.

do, presumably for this purpose. These do not use tunnels and are fully exposed to view. The method described in text books is as follows. By repeatedly passing through their bodies vegetable matter till all nutrient is extracted, they build up comb-like structures in excavated underground chambers, extremely light and porous, and sow (?) certain fungi on these, which at a certain stage of development produce small snow-white spheres wherewith they feed their charges, constantly stoking up the gravid female and dosing the young ones. It is even claimed that they keep pulling out any other fungi which may appear, and keep their gardens scrupulously "weeded." When a nest is deserted, the weed-fungi grow rapidly and ultimately appear above ground as mushrooms of sorts.

When a collection of white ants is disturbed, say, by moving a stone, the workers are thrown into violent confusion and soon soldiers make their appearance. An interesting case was noted and sketched by the writer in India. A crater-like hole was made around the struggling workers to see what they would do. In a very few moments, the edges were occupied by a perfect ring of soldiers with their bayonet-like jaws equally spaced as a guard. Communication had been quickly and surely conveyed. FLETCHER gives an interesting explanation of this. The contortions of the workers makes a distinct sound, sometimes audible at some distance, and he considers that this is their form of speech, and that definite forms of contortion with the resulting sounds convey very definite meanings. Based on this, a form of "termite findor" has been invented for locating the nest with the queen, consisting of a microphone attached to a sharp iron stake : the latter is driven into the ground, and if it reaches the nest the microphone records the fact. But when tried in India, the machine was found to be a failure for all practical purposes, as the location of the nest is almost impossible.

When a surplus of males and females have been formed in the colony, migration takes place. Streams of flying white ants, all males and females, issue from some hole in the ground. These are taken advantage of not only by human beings, but by the whole creation of living things, the birds and insects in the air and the creeping insects and reptiles on the ground. For the unaccustomed flight is feeble and erratic and lasts but a short time. One more observation, made by the writer, is worth recording. He watched a cloud of dragonflies darting into the middle of the flight. But the moment a dragonfly had seized a termite he appeared to drop it, and it went on crawling over the ground. Investigation showed that all the fallen termites were merely the forepart of the insects, head and wings and trunk, but without the long, white abdomen : the dragonflies were sufficiently sophisticated to know that this was the only part worth eating. When a termite finishes his or her feeble flight, it throws off its wings with a jerk and seeks a mate, regardless of enemies. Few survive, but here and there a pair finds safety in some crevice, and lays the foundation of a new colony. It is of course apparent that there is an appalling waste of life here, but what does that matter, with 30,000 eggs a day added to the numbers by one queen ?

C. A. B.

RUBBER LINING OF CHEMICAL PLANT has made great progress as the result of the discovery of American chemists that a horny, balata-like substance can be produced from rubber by the action of para toluene sulphonic acid and similar compounds. This product can be used for covering the interior of tanks and the like subjected to the action of highly corrosive liquids. It is possible if the cost of the material is reasonably economical that in the white sugar factory and refinery such a method of providing an iron-free surface would find use.

Does the Petree Process pay in Tucumán ?

By W. M. GRAYSON.[1]

In this day and time when the sugar industry of Tucumán has been so hard hit by over-production and low prices, one naturally pauses to consider how it is possible to lower production costs and at the same time keep up the usual standard of the sugar and yield. New processes are generally looked upon with scepticism, chiefly because people have so often been fooled into buying something that has not always given what the promoter has promised. So, it is quite natural that when anything new does come out that promises to "revolutionize" the industry, thinking people are rather slow to give it a good name until it has been tried and proved. One must be shown by a dollars-and-cents comparison over a period of several years that a new process does pay.

Due to many variations, seasonal variations from year to year in a cane-growing country like Tucumán, with the ever present danger of frosts early in the crop, it is very difficult in any one year to say that there has been any real benefit derived from any change in process ; but when a process has proved its worth over a period of several years, its net value must be recognized. Many difficulties have arisen on the way and been overcome ; many factors have entered, unforeseen factors like stoppages of the mill, with the consequent piling up of cane on the yard which deteriorates somewhat before it can be ground. But the real test is whether or not the advantages overbalance the disadvantages and whether the process has made money or lost it. Let us see then if the Petree Process pays dividends.

The Process was installed at the Ingenio Concepción for the crop of 1924. The previous year the usual procedure was practised, that is, there were open settling tanks, resettling tanks for the bottoms, and filter-presses for the scums. The clear-juice from the settlers was filtered through bag-filters and this juice together with the filter-press juice went directly to the evaporator supply tank. This station was in a rather remote part of the factory, quite a distance from the evaporators, and the temperature drop in the juice before it reached the heating surface of the evaporators was considerably lowered, probably some 15°C. No sulphur was employed in the defecation of the juice, only lime, as it was felt that as long as there was ample capacity in the refinery there was no need, with the increased cost of production, for making a white sugar, if the sugar were to be subsequently refined. The juice to the evaporators was clean, as clean as it is possible to make it without double filtration, though without the use of sulphur it had a milky or hazy appearance.

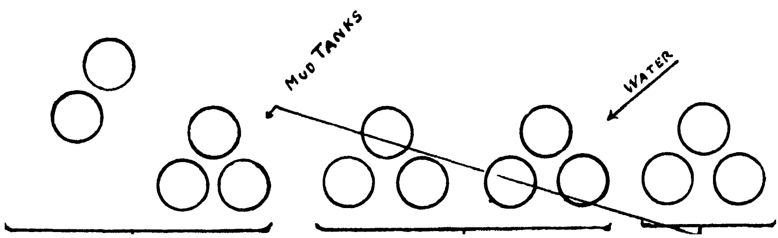
The idea of the Petree Process is to eliminate the filter-press station with its costly bills for labour, filter-cloths, additional lime, extra evaporation, and sugar losses, often undetermined on account of soft cake, bad sampling and weights. The other advantages sought are to increase the capacity of the evaporators and of the mills by furnishing a hotter juice to the evaporators and the consequent saving of steam.

During the first year of operation it was found that there had been an error in the design of the apparatus for Tucumán conditions ; and that there was insufficient settling capacity for the rate of grinding specified. The grinding rate which for 1923 had been 2418 tons per crop day was reduced to 2258 for that year, and the extraction was materially lowered. The insufficient settling capacity gave a large volume of mud in the secondary clarifiers, and the mills were unable to handle it. This resulted in a piling-up of the mud and of re-circulation. There was undoubtedly some re-expression due to the

[1] Translated from the *Revista Industrial y Agricola de Tucuman.*

mud passing through the blanket of bagasse and a mixing of juices in the "cush-cush," primary with secondary, so that at times the density of the secondary juice was as high as the density of the primary, and the settling therefore slower. Then too, there was an intermittent flow of juice to the clarifiers instead of a steady one, on account of the smallness of the mill juice tanks and the type of pumping equipment.

In this year the flow of juice was as indicated in the following diagram :—



1st Clarifier. 2nd Clarifier.

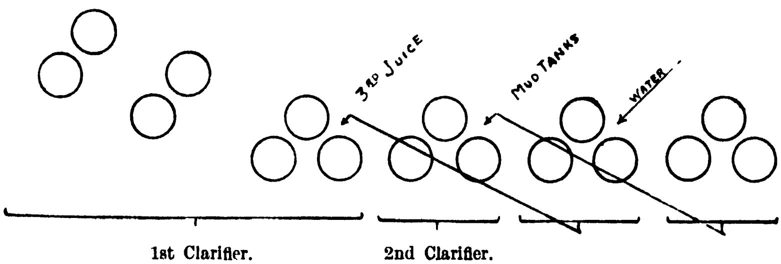
The primary juice consisted of the juice from the crusher and first mill, the secondary of the juice from the second and third mills, while the juice from the last mill containing all the maceration water was used to dilute the mud coming from the secondary clarifier, which went on the mills. The mud from the primary clarifiers was mixed with the cold secondary juice from the mills, limed and heated on its way to the secondary clarifiers, and the hot clean juice from the secondary clarifiers flowed by gravity to the primary juice tank at the mills, from which it was pumped after liming, through the heaters to the primary Dorrs. As above mentioned, the flow of juice was rather intermittent, due to the size of these tanks and the rather intermittent flow of juice from the mill pans, so that at times there was a large volume of juice passing the heaters underheated and a moment later a small volume that would be superheated, a rapid change that might not even be recorded by the thermometer. It was a condition not easy to control.

Another influence affecting the working of the process was the uneven feeding of the cane to the crusher, a condition found throughout Tucumán. The result was that at times there was passing a very thick blanket of bagasse on which very little mud could be put, while at others a very thin blanket through which the mud would pass. So noting all these disadvantages, as far as possible they were corrected and the capacity of the clarifiers was increased by adding two more compartments to each of the secondary clarifiers and one more to each primary, making all of them five-compartment machines. Since no changes could be made during the crop of 1924 and as the crop was a short one it was decided to grind slower and finish in the best manner possible.

In 1925 a change was made in the flow of juices to eliminate if possible any chance of re-expression. The last mill juice was pumped to a small mixing tank below the secondary clarifiers, and this juice mixed with the mud flowed by gravity to the bagasse entering the third mill instead of the second. Juice expressed by the third mill was pumped back as maceration in front of the second mill, so that any mud expressed would be recovered by filtration through the bagasse entering the second mill and at the same time the advantage of compound maceration would be gained. The flow of the other juices and the scums remained the same, although the volume of primary juice was increased by the addition of a pre-crusher and that of the secondary correspondingly reduced. This change is noted in the second diagram.

The effect of the changes was immediately apparent. The grinding rate per crop day increased to 2532 tons, which was 116 tons more than 1923 and 274 tons more than 1924. The sucrose extraction was increased to 89·39, as compared to 89·04 in 1923, while the sucrose in cane remained about the same, 10·26 against 10·21. The recovery, or the sucrose in sugar per cent. sucrose in cane, rose from 72·07 in 1923 to 73·28 in 1925 and the retention, or sucrose in sugar per cent. sucrose in juice, went from 80·95 to 81·98.

In 1926 for the first 100 days, the results were even better than in 1925, but towards the end of the crop abnormal conditions were encountered. Whereas the average Brix of the normal juice for the three preceding years was 16·52 and of defecated juice 14·73, from the middle of September until the 31st October the average Brix of normal juice was 19·40 and of defecated juice 16·00. This rise in Brix of n.j. of nearly three points made it necessary to increase to a much larger amount the maceration water to permit of more rapid settling, and this increased amount of water had two bad effects, namely, it increased the volume of secondary juice, and since it could be supplied in only one place (in front of the last mill) it washed out some of the mud from the bagasse which returned to the process instead of being eliminated. As it was, the grinding rate for that year was increased slightly



over the previous one, being 2581 tons per crop day. The recovery and retention rose to 74·74 and 82·14 respectively and the extraction to 90·99, due in part no doubt to the higher sucrose in cane that year which was 11·58.

These figures have been little changed during the crop of 1927 in spite of the lower sucrose content of the cane, 10·11. The recovery, retention and extraction being 74·7, 82·29 and 90·77 respectively. Due to improvements in the evaporating plant, the rate of grinding up to the time the small mill stopped definitely was 2860 tons per crop day, which represents an increase of 269 tons a day over the best previous year and 602 tons better than the worst. There were many successive days of 3,200,000 kilos and there were three runs of fourteen days each, during which over 41,000,000 kilos of cane were ground.

The usual method of clarification that has been followed by this *ingenio* for the last five years has been employed, that of lime without sulphur. At times phosphoric acid has been used for the improvement of the clarity and for the elimination of the colloids. Acidities have been controlled both by titration with N/10 caustic soda using phenolphthalein as indicator, and by the hydrogen-ion method using a comparator set. The secondary juices are carried slightly acid, the clear juice leaving at 0·8 c.c. of N/10 soda and 6·4 *pH*, which point we found to give the most rapid settling with the least volume and the hardest mud. The primary juice is limed to slight alkalinity 8·1 *pH* cold, and after heating to 100°C. leaves the clarifiers at

from 6·8 to 7·0 *pH* the neutral point, at which there is slight danger of inversion. As the purities of the secondary juices are from 6·0 to 8·0° below those of the primary, there is slight danger there of inversion either, as the acids are weak organic ones. Moreover, the influence of time is scarcely felt, as the total time the juice remains in the clarifier is just two hours when the mills are grinding at the rate of 3200 tons per day.

Experiments made by C. F. WALTON, M. A. MCCALIP and W. F. HORNBERGER of the Bureau of Chemistry, Washington,[1] have shown that a juice of approximately 80·0 purity with acidities from 0·00 to 0·45 cc. N alkali per 100 ccs. of juice and with a *pH* of from 6·5 to 8·25, showed a loss of only 0·04 to 0·18 per cent. of the contained sucrose after four hours heating at 100°C. Similar experiments made by the Hawaiian Experiment Station demonstrated that juice limed to neutrality to phenolphthalein and heated to 100° C., and maintained at that temperature for four hours, showed practically no loss of sucrose.

Recently in the work carried on by H. S. PAINE and R. T BALCH on hydrogen-ion concentration and juice defecation[2] it was shown that certain types of juices required for the maximum defecation the liming to a *pH* value between 8·0 and 9·0 for cold juice, but it was possible at times to obtain a fairly brilliant juice at a *pH* of between 7·6 and 8·0. However, as the *pH* gradually falls after heating and the rate of decrease depends on the initial *pH*, the time of heating, temperature and the character of the juice; and as inversion is detectable at a *pH* of 7·0, it is advisable to so lime that the juice reaches the syrup stage at a *pH* value not less than 6·8 to 7·0. However, there are other considerations besides inversion to be considered in cane juice defecation, namely the percentage of lime salts in the defecated juice and the colour of the juice.

It is also stated in another article[3] by J. T. KEANE, H. A. MCCALIP and H. S. PAINE, entitled " Effect of *pH* on Lime Salts and Character of Colloids in Filtered Juice from Cane Muds " that when the mud coming from the defecators was resettled after diluting, liming and heating, neither was the quality of the juice improved nor the rate of settling, and that when lime was added to the muds before sending them to the presses, although the filtrability was improved the purity of the filtered juices was decreased and considerable quantities of lime salts were formed. Nor only are the lime salts harmful but they increase the reversible colloids in the juice.

In another article are given the results of simple defecation and double defecation of cane juices, the procedure being as nearly as possible that used in sugar-house operations. These results show that colloid elimination was distinctly greater in double defecation than in single, and that the double defecation gave a greater rise in apparent purity as well as a slightly better general appearance. This is attributable to colloidal elimination by the acid defecation of low purity juices when the quantity of mud is proportionately large.

The fact that in the Petree Process this procedure is carried out and there is no necessity to add lime to the mud to make it filter, as is often the case with sulphured juices, there is evidently an increased elimination of gums, waxes, etc., even though there might be some re-dissolved impurities from the mud if large quantities of imbibition water were added.

Although the juices had at all times a haze, it was very free of *bagacillo* except at times when large amounts of burned cane were ground continuously (some of the lighter particles, colloidal in nature, remaining in suspension).

[1] *I.S.J.*, 1925, 265. [2] *I.S.J.*, 1927, 221. [3] *I.S.J.*, 1928, 32.

No doubt this haze could be eliminated with the use of sulphur, but it hardly seems worth the expense, especially since the sugar made for refining is of such good quality. That the sugars were good for refining is shown by the analysis, pol. 98·88, ash, 0·194, glucose 0·192, which compares favourably with the raw sugar made by our other factory, Lujan, in which the juices are sulphured, limed, decanted and clear-juice filtered through Danek filters, pol. 98·02, ash 0·548, glucose 0·551. Another evidence of the increasing better quality of our sugars has been in their filtrability. At no time has the Vallez filter station been crowded and the consumption of filter-aid, "Supercel," has been steadily reduced from the first installation of the filters in 1924, from 5·83 kilos of "Supercel" per 1000 kilos of refined sugar to 4·61, 4·49 and 4·13 in the last three succeeding years.

There is no doubt that the Petree Process has given cleaner juices and a better elimination of the gums and waxes, as is evidenced in the pan work. Massecuites have boiled much freer; it has not been necessary to wash out a pan during the entire crop, and in spite of the increased grinding rate the third sugars have as a rule dried very well. There were times, when from low purity juices the purities of the third massecuites went as low as 50°; these gave trouble, but not to such an extent as to require a slowing down or stoppage of the mills. There is a lack of capacity in the third sugar centrifugals, being only 0·0204 cubic metres per ton of cane per hour. But in spite of the increased grinding rate, with no increase of centrifugal capacity in five years, the quantity and purity of final molasses have shown no increase.

In trying to prove as good or better clarification with the Petree Process as with those factories which operate with filter-presses, it is rather difficult on account of the fact there is no true normal juice figure. It is rather unfortunate that we made no complete analysis of first mill juice in 1923, for then we could have compared results in the same factory. But the averages taken from some reports of the other factories show that there is a fall in purity from the first mill juice to normal or mixed juice of about 1·95. Also there is a rise in purity from the normal juice to defecated juice of about 0·96. Some factories show more and others less, one factory showing a drop in purity from normal juice to defecated.

Taking our averages for the last four years, we find the purities of the first mill juices 78·41, and defecated juice 77·81. Subtracting the average drop in purity of 1·95 from first mill juice would give us a calculated purity of normal juice of 76·46, and adding the average rise in purity from normal to defecated of 0·96 gives us a calculated purity of defecated juice of 77·42. The actual purity of this juice from the daily analysis was 77·81 or 0·4 higher than that. Using the same line of thought for the past crop alone, we have an even more marked difference. From the purity of the first mill juice, 78·41, is subtracted 1·95 and added 0·96, giving us a calculated purity of defecated juice of 77·42, whereas the actual purity was 78·52 or 1·1 points higher. This in the writer's opinion indicates good clarification, and points out the advantage of double defecators.

Having seen that just as good or better work obtains with the Petree Process as without it, in what way does it pay? First there is a saving of labour and filter-press cloths; there is a saving of most of the sugar ordinarily lost in press-cake, and that not accounted for in slopping over tanks, leaky presses and soft cakes; there is a saving of heat, due to less radiation and hotter juice to the evaporators; then there is the gain in fuel of the organic matter in the press-cake which formerly had to be carted to the fields. Below are itemized these gains.

The saving of labour then is 51 men per day at \$3·50 Arg. currency for 133 days or 51 × 3·50 × 133 = \$23,740·00 Arg. currency.[1]

Labour.	Filter-Presses.			Petree Process.	
Foremen	1 × 3 turns	3	..	1 × 3 turns	3
Lime mixing	2 × 3 „	6	..	2 × 3 „	6
Liming tanks	2 × 3 „	6	..	2 × 3 „	6
Heaters	1 × 3 „	3	..	1 × 3 „	3
Pumps	1 × 3 „	3	..	1 × 3 „	3
Settlers	2 × 3 „	6	..	2 × 3 „	6
Resettlers	2 × 3 „	6	..	—	
Bag Filters	4 × 3 „	12	..	—	
Truck men	4 × 3 „	12	..	—	
Washers	3 × 3 „	9	..	—	
Unloaders	4 × 3 „	12	..	—	
TOTAL		78			27

Filter Cloths.—The cost of filter cloths per ton of cane has been at a conservative estimate, \$0·12 per ton of cane ground ; 372,317 tons × \$0·12 = \$44,678 Arg. currency.

Saving of Sugar.—Assuming 7 per cent. sucrose in press cake and 1·8 per cent. mud on cane, the loss of sucrose per cent. cane will be 1·8 × 0·07 = 0·126. As the bagasse left the mills with 3·26 per cent. sucrose and as the weight of mud was reduced from 1·8 to 1·08 due to the correction for difference in moisture content, the loss of sucrose in the mud is reduced to 1·08 × 0·0326 = 0·035. The gain then in sucrose is therefore 0·126 less 0·035 or 0·091 per cent. cane, of which 0·8229 is available as refined sugar. 372,317 × 0·00091 × 0·8229 = 279·237 tons sugar, which at \$250 Arg. currency the ton gives a saving of \$69,800 Arg. currency.

Saving of Heat.—The cost of producing steam in a factory burning say 4 per cent. wood on cane and grinding 3,000 tons of cane per day with 28 per cent. bagasse on cane is arrived at in the following manner :—One ton of wood is equivalent to about two tons of bagasse, so that the wood equivalent of bagasse is 3,000 × 0·28 divided by two or 420 tons. To this is added the extra wood of 4 per cent. or 120 tons, making a total of 540 tons which at \$16 Arg. currency per ton amounts to \$7,640 per day. The labour involved at the boiler room and on the wood pile amounts to about 90 men per day, which at \$3·50 Arg. currency is \$315 per day, making a total of \$7,955 a day. This factory will produce about 100,000 kilos of steam per hour, which makes the cost of this production :—\$7,955 Arg. currency divided by 2400 = \$3·31 per 1000 kilos of steam.

There was a drop in temperature of almost 15°C. or approximately 15 cal. per kg. of juice. This was a direct loss, though some of it could be saved by proper lagging of defecators, mud tanks, etc. We will assume therefore a loss of only 10 cal. per kilo. Then the loss for the crop would be 372,317,000 × 0·80 dilute extraction × 10 or 2,978,536,000 cal. Since one kilo of steam at 0·8 atmosphere gives up 540 cal. in condensing, there will be required roughly 5,500 tons of steam at \$3·31 per ton or \$18,200 for the crop.

Looking at it from another angle 2,978,536,000 calories divided by 2500 calories, the fuel valve of wood, we have 1,191 tons of wood lost which at \$16 equals \$19,000 for the crop.

Gain in fuel.—The gain in fuel will be the quantity of combustible in bagasse due to the mud which formerly went out in the press-cake. From

[1] The Argentine gold Dollar is just under 4s. at par.

past records this mud was 1·8 per cent. of the weight of cane and carried about 60 per cent. moisture. From the weight of this mud must be subtracted the weight of the lime added and also the weight of the lime precipitate. Lime used for the past crop per cent. cane was 0·075, while the weight of the precipitate must be calculated from the rise in the purity of the juice. Defecated juice analysing Bx. 14·62, sucrose 11·48 and purity 78·52, would give a mixed juice analysis of Bx. 14·80, sucrose 11·48, purity 77·56, using the line of reasoning above indicated. The loss of solids, then, with the same specific gravity as sugar would be 14·80 — 14·62 = 0·18 per cent. juice and per cent. cane would be 0·18 × 79·9 or ·014 per cent. On 1000 kilos of cane then we will have 1000 × 0·018 or 18·0 kilos of mud, from which will have to be deducted 1000 × 0·00075 or 0·75 kilos of lime, and 1000 × 0·0014 or 1·4 kilos of precipitate, leaving 15·85 kilos of mud, bearing moisture and combustible. Since the original solids were 18·0 × 0·3 or 5·4 kilos of solids, there remains 3·25 kilos of combustible, which corrected for 50 per cent. moisture in bagasse gives a bagasse equivalent of 6·5 kilos per 1000 kilos of cane.

Then 372,317 tons of cane × 6·50 equals 2,500 tons of bagasse, which at 8·00 the ton, gives a value to this fuel of $20,000 Arg. currency per crop. Summarizing then we have total gains equal to :—

	Arg. currency. $
Labour	23,740
Filter-cloths	44,678
Sugar gained	69,800
Heat saved	18,500
Fuel gained	20,000
	$176,718

This saving amounts to more than $0·47 per ton of cane and about $0·06 per 10 kilos of sugar ; and the answer is that it does pay.

Sugar Cost Accounts.[1]

A Description of the System adopted by the Ste. Madeleine Sugar Co., Ltd.

By the late G. C. SKINNER, General Manager.

The land owned by the Company comprises roughly some 24,500 acres, of which 11,500 acres are under estate cultivation, 6000 acres are rented to cane farmers, 5700 acres are uncultivated, and 1300 acres are pastures and traces. This area is made up of several adjacent estates which are grouped into four large sections. These estates are well served with a network of private railways, totalling about 80 miles of standard gauge and 10 of 3 ft. gauge; whilst the Trinidad Government Railway crosses from east to west and on the eastern side of the estate from north to south. The factory is practically in the centre of the properties, and is capable of dealing with around 3000 tons of cane daily ; between 25,000 and 30,000 tons of sugar are made yearly. Approximately two-thirds of the cane is estate grown and one-third is grown by cane farmers ; of this latter a considerable portion is grown on lands which do not belong to the Company. The employees of the company (including

[1] Summarized from a Supplement to *Tropical Agriculture*, October, 1928, published by the Imperial College of Tropical Agriculture, Trinidad, B.W.I.

peasant cane-farmers, many of whom divide their time between their own cultivation and that of the estate) number between 10,000 and 11,000.

To see how all the numerous workers are connected together, reference should be made to the Organization Chart (Appendix 1[1]) which shows the chain link by link, from the labourer in the field, or factory, to the Chairman of the Board of Directors. Appendix 2 shows how the expenditure is dealt with from the Line List to the final local accounts as forwarded to London Office. There are two main sections, i.e.; "Factory and General" and "Estate." The former is sub-divided into the Factory, Transport, General and Medical Sections; the latter is divided into the Estate and Farmers' Sections. A representative division of expenditure is shown in Appendix 3, which gives in diagrammatic form the percentage distribution amongst sub-sections of the sectional expenditure.

We will take the estate expenditure first, and working from bottom up we start with the *Line List*: This is a plain ruled pocket book which is kept by the overseer and is used by him for taking a list of and pricing the labourers daily. When visiting the fields in the morning he takes down the names of all those at work, keeping the different gangs separate. Above the list of names for each gang he records the number of the field in which the work is being done, the class of work, and the rate being paid. In the afternoon, after the work has been measured up and priced, he places the amount earned by each against the name. From the Line List the *Pay Roll* is written up, and the overseer compiles his *Daily Abstract*. This form (Appendix 4) is the key to the accounting system.

On referring to the Daily Abstract it will be seen that the following information is made readily available :—Number of field in which work was done; number of labourers employed in each operation; number of animals employed in each operation; size and rate of task; number of tasks worked; description of work; daily earnings for each unit of labour; section to which it is to be charged; total amount, and where chargeable in the ledger.

The field expenditure, as will be seen from Appendix 2, is entered in detail in the Field Ledger, the totals of which are posted to the Expenditure Ledger. Other work such as that in connexion with stock is posted direct to the latter. In the *Field Ledger* separate accounts are kept for each field. The main heads of expenditure are :—

Digging para grass; preparing land; tractor ploughing; drilling; round ridging; sub-soiling; planting; pen manuring; green dressing; draining; weeding; forking; applying artificial manure; reaping, etc. These headings are further sub-divided.

Appendix 5A is the Detail Sheet, one of which is used for each sub-head, and is printed on white paper. Appendix 6 is the "Total" page for each sub-head, and is printed on blue paper. Appendix 7A is the Control Sheet which gives the analysis of all expenditure on the particular field for the year, and is printed on pink paper.

The totals of this ledger are posted *via* a Summary Statement to the *Expenditure Ledger*, Wages column. As will be seen from Appendices 8 and 9 this ledger is also made up of Detailed and Control Sheets, the first being printed on white paper and the latter on pink. The foregoing disposes of the wages section of the Estate Ledger. Cash expenditure other than wages is analysed fortnightly, and posted to a Detail Sheet (Appendix 10) and from

[1] In the original paper 30 specimen charts and tables are given (Appendixes 1—30) which we are precluded from giving here.—ED.

there to Cash Expenditure Column of the Control Sheet (Appendix 11) which, it will be observed, is the same as Appendix 9.

London Debit Notes are dealt with in a similar manner; the remaining column, *Inter-Estate Accounts,* represents charges for work done by one Estate for another. This information is posted to the Expenditure Ledger from a fortnightly analysis of the Debit Notes or *via* the Field Ledger, as the case may be. The list in Appendix 12 gives the headings of the "Control Sheets" generally used, but these may be increased or altered at will. Those marked with an asterisk also appear in the Field Ledger. This completes the description of the manner of charging all Estates expenditure, but before going on to the Factory side one or two observations should be made on the benefits that are derived from a system which seems to be rather laborious but is in practice very simple.

Prior to putting in this system, huge unwieldy Analysis Sheets were forwarded fortnightly to the Central Office. These gave such information as the amount spent on "Forking"; "Weeding"; "Stock Food"; etc., but the Central Office had no means of tracing how these amounts were made up, or which fields were worked. To everybody's knowledge a great deal of "cooking" took place, and in addition the information was received at headquarters more than a fortnight after the work had been done, whereas now it comes in the day after.

To-day there are several means of checking the information supplied. When riding round the estate one can make a note of the work being done in a particular field and number of people employed, and on the following day one can see whether it has been properly recorded in the Abstract. Formerly there was great difficulty in the manager of one estate finding out what his neighbour was paying for any particular work. To-day every manager or overseer has the right to go over any estate's ledger where full information on every point will be found. The office staff now check up regularly the expenditure under each heading for every field, and if cost per acre does not tally with rate paid the overseer is called upon to explain.

Factory Ledger (*Appendices* 16-20). This, of necessity, has to be divided differently from the Field Ledger. The costs are divided into "Running" and "Maintenance." The Detail Sheets, as in the case with the Field Ledger, are printed on white forms. The total "Running" forms are pink, the "Maintenance" blue, and we also have Control Sheets which amalgamate the Running and Maintenance and these are on yellow paper. The method of posting from one to the other is really the same as with the Field Ledger and it is therefore not necessary to go into this in greater detail.

Another difference between the Factory and Estate accounting is the manner of handling the stores. On the Estates, the stores are charged up in bulk either from the merchants' invoices or from the Factory Debit Notes, but with the factory, all stores purchased go into stock and are charged out as consumed, however small the amount. A requisition is made to the Store on a *Stores Order Form* (Appendix 21) signed by one of the Engineering Staff, containing a note of what is required, and where the amount is to be charged.

These order forms are filed in their proper place until the end of the day when they are entered up in the *Stores Charge Book* (Appendix 22). In this book it will be noticed that the stores are detailed and a price placed against each item. The total of each heading is posted to the material column in the Factory Ledger—Detail Sheet—daily, and, as in the case of Wages, totals are posted to Control Sheets fortnightly.

Cash Expenditure, Inter-Estates Accounts and London Accounts are treated in exactly the same manner as previously described. Appendix 23 gives a list of Main Headings of Expenditure for Factory, Transport, General and Medical. There are, of course, a very large number of sub-heads, as every piece of machinery in the factory, every loco., etc., has its own account. It might be mentioned that replacements and new machinery go through the "*Maintenance*" section, but under separate sub-heads.

The previous account about covers the methods adopted as regards costing. There are, of course, various accounts such as Cash Accounts, Personal Ledger, etc., but these are all kept in a similar manner to those of most firms. There remains the question of accounting for the produce, and the method of keeping track of the cane may be worth mentioning

Estate Cane.—The cane when cut is either carted or headed to railway waggons. The carted cane is usually weighed on the cart and the carter is paid by the ton; but headed cane cannot be weighed until it arrives at the factory, and headers are therefore paid by the truck. Immediately a truck is loaded, the Overseer in charge of this work makes out a truck ticket (Appendix 24) stating the name of the Estate, the truck number, and date of loading.

This ticket is placed in a pocket provided on the truck. On reaching the factory scale the weight of the truck is punched on the ticket. It is then placed in a pigeon hole with other tickets from the same Estate, and at the close of the day these are all sent up to the Central Office with a list of trucks and weights for the day (Appendix 25). The Field Overseer, at the close of his day's work, makes up a statement (Appendix 26) showing all trucks loaded for the day—giving truck and ticket numbers, also the field from which the cane was reaped and the name of the loading station. On arrival at the Central Office these forms are checked up with truck tickets received through the factory cane weigher. The tickets are then returned to the Estate together with a certificate (Appendix 27) of the weight of cane received for the day. Each week the estate sends in a form (Appendix 28) giving information as to the tonnage and date of reaping of each completed field. Before being entered on the Control Sheet of the Ledger this information is checked at the Central Office from information obtained from the truck tickets.

Farmers' Cane is almost invariably brought to the loading place by carts, but occasionally farmers, through whose land a railway runs, are allowed to load direct into trucks. On arrival at a scale the carts are weighed and a receipt (Appendix 29) given for each load. The Farmers' Ledger is posted from the duplicate of this receipt. The Cane Weigher sends in a detailed list of all loads brought during the day showing the total weight loaded into each truck (Appendix 30). As these trucks are re-weighed at the factory yard there is ample check on the weights.

Chemist's Report.—The method of accounting for the cane after it arrives at the factory yard is covered by the Chemist's Report (Appendix 31).

FORMOSAN SUGAR PRODUCTION.—According to the Department of Overseas Trade, the second official estimate puts the production of sugar in Formosa for the season 1928-9 at 11,941,540 piculs (about 705,000 tons) of centrifugals and plantation white, and 188,135 piculs (about 11,000 tons) of brown sugar, making a total of 12,129,675 piculs (over 716,000 tons). This represents an increase of more than 16,000 tons as compared with the first estimate, and of 2,462,058 piculs (over 145,000 tons) over the previous record of 1927-8. The estimate is based on conditions existing at the end of October. The increase is attributed to the expansion during the year by over 30,000 acres of the area under sugar cane, combined with the spread of superior varieties of cane and intensive methods of cultivation.

City and Guilds of London Institute's Examinations.

Attention is again called to the Examinations in Sugar Manufacture (Grade I and Final) conducted by the City and Guilds of London Institute. These have come to be regarded as a useful qualification for the young sugar chemist. Intending candidates are reminded that the next examination will take place on Tuesday, April 23rd, 1929 ; and that they should make their entries by March 9th, addressing them to the Secretary of the nearest Technical School. If candidates are in doubt as to where they should apply, they should communicate with:—The Superintendent, Department of Technology, City and Guilds of London Institute, Exhibition Road, London, S.W.7, who will inform them of the nearest centre at which their entry would be accepted. The following is an example of the paper set for Grade I :—

(1) Define *any six* of the following terms : Low green syrup ; entrainment ; concretor ; mother-beet ; specific rotatory power ; blackstrap ; pectin ; trash-turner. (2) Outline the most important operations involved in the harvesting of *either* sugar cane, *or* sugar beet. (3) Sketch a sugar centrifugal machine, describe its essential construction, and give a brief account of its operation. (4) How would you determine the degree of alkalinity of a sugar product. (5) Give the average composition of *four only* of the following products : Clarified cane juice ; clarified beet juice ; cane factory first massecuite ; beet factory second massecuite ; refinery spent char ; commercial limestone ; kieselguhr (diatomaceous earth) ; final molasses (as obtained either in the cane or the beet sugar factory). (6) Describe with the aid of sketches *one only* of the following accessory apparatus : A steam trap ; a save-all ; a bagasse conveyor. (7) How would you proceed in sampling *one only* of the following products, and what precautions would you especially observe in order to secure a true average sample : cane mill juice ; beet filter-press cake ; raw cane sugar (96° test) in bags in a warehouse ? (8) Discuss what occurs in *one only* of the following operations : the liming of cane juice ; the carbonatation of beet juice ; the defecation of refinery raw liquor. (9) Explain how animal charcoal is washed and revivified in the refinery. (10) What are the principal causes of the loss of sugar in *either* raw sugar production *or* in refining ? How may each be reduced to a minimum ?

For the Final Examination the following paper was recently set :—

(1) Define *any six* of the following terms : "Commercial cane sugar" ; saccharin ; saccharan ; saccharetin ; attenuation ; coefficient of transmission of heat ; bi-quartz ; cross-fertilization. (2) Give a clear account of how you would operate hydrogen-ion control in your factory or refinery. (3) Write a short essay on *either* the utilization of molasses, *or* the disposal of beet factory effluents. (4) Regarding *any one* of the following irregularities, state the cause, and describe what measures you would take in order to contend with it : difficult pan boiling in the cane factory ; slow carbonatation in the beet factory ; the gradual increase of the carbon content of char in the refinery. (5) Enumerate the constituents present *either* in raw cane juice, *or* in beet diffusion juice, and state the proportions in which each may be present. (6) How would you determine the amount of sucrose present in a sample of cane molasses using the double polarization method ? Mention any possible sources of error, and discuss their avoidance. (7) Write an account of *one only* of the following processes : De Vecchis ; "Suchar" ; "Celotex." (8) Describe with the aid of sketches *any one* of the following, and discuss its practical operation : a lime kiln ; a bagasse furnace ; a char revivifying kiln. (9) If you were responsible for the purchase of the chemicals used in a factory or refinery, state the specification to which *any two* of the following should in your opinion conform : caustic lime ; kieselguhr ; sulphur, animal charcoal. (10) Outline the method of chemical control which you would institute in your factory or refinery. Draw up a balance sheet showing the amount of sucrose which might be present in the different products, and that lost.

Preferential Rates.—The last Customs Tariff brought into force in Mauritius provides for preferential rates in many cases on imports from Great Britain. Machinery for the manufacture of sugar is taxed Rs. 1·32 per metric ton, whereas from other countries the duty is 5 per cent. *ad valorem.*

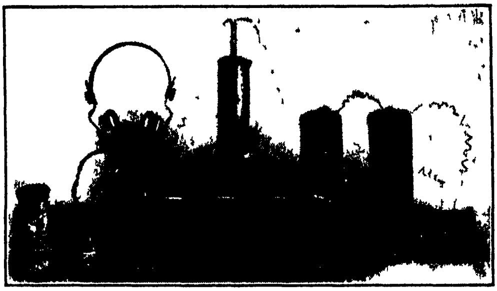
Conductivity Ash Determinations in Sugar Factories in Natal and Mauritius.

By R. G W. FARNELL, A.I.C, A.R.C.S.

The following notes describe some of the results obtained with the "Salometer"[1] in certain sugar factories in Natal and Mauritius.

The set was used exactly as received without any modifications, and it was found to be very simple and practicable, affording accurate results in the minimum of time.[2]

Three months were spent at the Illovo sugar factory, Natal : many others were visited, and also several in Mauritius. At Illovo there were opportunities of using the "Salometer" both in the raw factory and in the Suchar Refinery.



The factors correlating conductivity and gravimetric ash were determined experimentally and were found to agree well with those of Zerban,[3] and LUNDEN.[4] The following dilutions and factors were employed for the various sugar products examined :—

		FACTOR
RAW PRODUCTS.		
Juices	10 c.c. diluted to 200 c.c.	79
Syrup	10 c.c. " " " "	87
Raw sugar	10 g. " " " "	79
REFINERY PRODUCTS.		
Melt	10 c.c. " " " "	79
Filtered liquor	10 c.c. " " " "	79
Refined sugar	10 g. " " " "	84

For solutions the calculation of ash is made as follows ;—

$$\text{Ash per cent. Brix} = \frac{\text{cell constant} \times \text{factor} \times 100 \times 100}{\text{resistance} \times 5 \times \text{sp. gr.} \times \text{Brix}}\ ; \text{ and}$$

$$\text{for sugars :—Ash per cent} = \frac{\text{cell constant} \times \text{factor} \times 100}{\text{resistance} \times 5}$$

Corrections were applied both for the temperature and the conductivity of the water used for dilution, though the temperature was kept as near 20°C. as possible. Factory condensed water was generally used for dilution, the conductivity being sufficiently low, viz., 0·000005 to 0·000015 mhos.

The cell constant remained very steady during the period in question, lying between 0·26 and 0·27. The electrodes showed no trace of corrosion or discoloration. Generally speaking, a conductivity ash analysis could be carried out in less than five minutes. The results found on the different products in the various factories visited are averaged below.

[1] *I.S.J.*, 1928, 30, 205.
[2] It is sold by The Sugar Manufacturers' Supply Co., Ltd., London.
[3] *I.S.J.*, 1926, 364, 610.
[4] *I.S.J.*, 1926, 560.

Ash Determinations in Sugar Factories in Natal and Mauritius.

Sugar Factories	Mixed Juice	Ash per cent. Brix. Clarified Juice.	Press Juice	Syrup.	Ash per cent. Sugar.
NATAL					
average	3·59	4·10	6·83	3·52	0·45 (97·4*P*)
maximum	5·45	5·56	10·22		
minimum	2·68	3·30	4·08		
MAURITIUS					
average	3·20	3·86	4·24	3·11	0·20 (99·2*P*)

ILLOVO REFINERY, NATAL

	Ash per cent. Brix.
Melt, average	0·160
Filtered, average	0·170
Liquor, average	0·017
Refined sugar, average	0·017
Refined sugar maximum	0·028
Refined minimum	0·005

Examining first the results obtained in the raw factories, the ash throughout is higher in Natal than in Mauritius. The high chlorides in Natal juices and molasses are notorious, and adversely affect the recovery. There is a big fluctuation in the ash in the Natal juices, the " flats " cane in Zululand giving very high fixures (over 5 per cent. Brix).

There is invariably an increase in ash during clarification by sulpho-defecation, and the large quantity of ash introduced at the filter-presses by excessive liming does not appear to be eliminated even when the filtered juice is returned to the mixed juice and undergoes a second clarification.

There is a marked drop in ash between the clarified juice and the syrup irrespective of whether phosphoric acid is added to the syrup. This reduction in ash of course is due to the precipitation of insoluble lime salts (sulphite, sulphate, phosphate and silicate) during concentration in the evaporator. Where the syrup is treated with phosphates, the ash may be further reduced by 25 per cent. or more, owing to the precipitation of tricalcium phosphate.

In the Illovo refinery the very slight increase in ash in the filtered liquor (from 0·16 to 0·17 per cent. Brix) is caused by the addition of a small amount of sodium carbonate in order to raise the *pH*.

The conductivity method has been largely used in refineries (see, e.g. MAIN,[1] LUNDEN[2] and LANGE[3]) and is indispensable for determining rapidly the ash content of raw sugar, affording an indication of the rendement.

In the raw sugar factory the conductivity ash method provides the chemist with a new simple means of controlling the clarification, since an excessive rise in conductivity from mixed to clarified juice at once points to irregularities in defecation or filter-press work, as pointed out by HONIG.[4]

BRITISH INDUSTRIAL SOLVENTS, LTD., has just been registered as a private company. Its capital is £500,000. The company will carry on the business of manufacturing industrial alcohol and other forms of chemical products. Agreements have been entered into between the new concern and the Distillers Company, the Methylating Company, and Holzverkohlungs-Industrie A.G.

FARREL CANE KNIVES.—In our October and November issues we published an advertisement of the Farrel-Birmingham Co. Inc., describing their revolving cane knives. It was stated in the text that records showed more than 5 per cent. increase in sucrose extraction by using them. In justice to the firm, we have to point out that the figure should have been " 0·5," a more rational result as will be realized. The decimal point in the copy was accidentally overlooked in setting the advertisement, hence the error, which we greatly regret.

Australian Sugar Production in 1927 and 1928.

Bureau of Sugar Experiment Stations Annual Report.

The twenty-eighth Annual Report of the Bureau of Sugar Experiment Stations, Queensland, dealing with the year ending 15th November last, has the following information on the results of the 1927 crop year and the estimated production of 1928.

According to figures supplied to the Registrar-General, the production of raw sugar of 94 net titre for the year 1927 in Queensland constituted a record, it being 485,745 tons, or 160 tons in excess of the previous record in 1925. Although this may be considered a record so far as tons of sugar manufactured are concerned, yet as the area from which cane was crushed in 1927 was 14,282 acres more than in 1925, the yield of cane per acre was not so good, being 19·36 tons in 1925 and 17·45 in 1927. The tonnage of cane from which the 1927 crop was produced amounted to 3,555,827 tons, as compared with 3,668,252 tons in 1925, so that the tons of cane required to make one ton of sugar were less last season. The amount of sugar exported in 1927 was 152,384 tons, as against 211,000 exported in 1925.

The proportion which the sugar required for consumption in the Commonwealth of Australia bore to the total production in Queensland and New South Wales. in 1927, was 68·82 per cent. The net value per ton of the 94 net titre surplus sugar sold abroad was £12 2s. 6d., which was not so high as in 1926, when it was £14 18s. 10d. In respect of the raw sugar deemed to have been delivered and required for consumption and use within the Commonwealth of Australia, the Sugar Board were able to declare a payment of 10s. per ton on 94 net titre sugar in addition to the price of £26 prescribed for such sugar. The average payment that the Queensland and New South Wales sugar industry received for the whole crop was £22 0s. 4d. per ton of 94 net titre sugar. This, owing to the greater export, was not so high as in the previous year, when it reached £24 10s. 10d.

The agreement between the Commonwealth of Australia and the State of Queensland for continuation of sugar prices and the maintenance of the embargo on imported sugar expired on the 30th August, but was renewed for a further three years during the present year. The Federal Government has the right under the new arrangements to revise Australian prices if increased preference is granted to export sugar from Australia by Great Britain or any Dominion.

The exports of sugar since 1924, when the first large surplus was manufactured, are as under :—

	Tons.		Tons.
1924	74,000	1927..........	152,384
1925	211,000	1928 (estimated)	185,000
1926	74,777		

A certain amount of clamour is still being raised by consumers in the southern half of the Australian Commonwealth as to the price of sugar; but it is pointed out that the average Commonwealth cost of all foods and groceries has increased by 74·5 per cent. since 1914. In Sydney prices in that period have increased by percentages varying between 50 and 92·6; sugar is the lowest of all at 50 per cent. increase, meat comes next at 51·2, while bread is 70·8, and milk 92·5. On the other hand, basic wages have increased by 82·7 per cent. It is therefore clear that the increase in the price of sugar offers little if any scope for criticism. Production of sugar has been governed by the same laws as have influenced the rise in the other foodstuffs.

The export of sugar is of great benefit to Australia; it is estimated that during the past four years some £7,000,000 have been received for sugar sent

abroad. In addition, something around 5000 tons of sugar is exported annually in manufactured articles.

The 1928 season was wet in the earlier part of the year in all sugar districts, and excessively wet in the South. The rains were followed by a long period of dry weather, which induced an early arrowing of the crop, more particularly from Mackay north. While latterly the cane crop was not so good as was anticipated earlier in the year 1928, the commercial cane sugar in the cane has been remarkably high, and most mills have manufactured sugar from a smaller number of tons of cane than at any time heretofore. Serious floods, cyclones, and frosts were not experienced, and labour in the mills and fields worked steadily throughout the season. Some difficulty in connexion with storage capacity was experienced by one or two mills during the recent waterside trouble, and many farmers loaded and manned small vessels in North Queensland to get their sugar away to the Southern States.

The preliminary estimate formed in June was for a crop of 3,856,500 tons of cane ; but at the end of October this had been reduced by some 90,000 tons. If the later estimate is realized, the 1928 crop should produce some 3,767,681 tons of cane. If as is hoped only 7·15 tons of cane is needed to make one ton of sugar,[1] then the production of raw sugar of 94 net titre may reach approximately 527,000 tons, which would be another record, and by far the largest tonnage of sugar ever produced in Queensland. The anticipated yield of sugar in New South Wales in 1928 is about 16,700 tons, which will bring the Australian production of raw cane sugar up to 543,700 tons. In addition the Maffra factory turned out 2,349 tons of beet sugar.

Beet Factory Technical Notes.

Pressure Evaporation.—Last month the adverse experience of Janko Prochazka, a Slovakian beet sugar factory manager, regarding pressure evaporation was quoted.[2] It is worth while now to note the comments of Mr. Karl Vesely, Manager of the Wissington factory, on this subject,[3] one of not a little importance to manufacturers of white sugar. He remarks that it would be interesting to ascertain why it was not possible at the Oroska factory to obtain light-coloured juices in the pressure evaporator, when in a great number of new factories entirely satisfactory results in this respect are realized. It cannot be due alone to the temperature in the evaporator, rather should the cause be sought in the construction of the bodies themselves.

It is true, moreover, that the colour of the juice is a function of the temperature and the time, but in addition to this correct saturation and filtration, and the presence of sulphites are also factors. Unsulphited juices are coloured by high temperatures considerably more than those which are sulphited ; these, Mr. Vesely finds, give a faultless white granulated sugar, approaching in appearance closely to the granulated of the refineries.

It is a fatal mistake to construct a pressure evaporating plant from horizontal bodies, or from old Robert bodies. Wissington has a quadruple pressure evaporator consisting of a Kestner body of 150 sq. m., functioning as pre-boiler, and taking fresh steam (reduced to the necessary low pressure by a Locke's regulator), and three vertical rapid steam bodies of 360, 400 and 440 sq. m. surface with tubes of 3070 mm. length and 34 × 31 mm. width. The

[1] The average for the past nine years is 7·65.
[2] *I.S.J.*, 1929, 36. [3] *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, No. 19, 204-206.

Kestner has tubes 6120 mm. long and 38 × 34 mm. dia. These bodies were built by the Skoda Works, and form a perfectly operating pressure evaporating apparatus, as figures for the colour in Stammer degrees per 100 of polarization show. It is mentioned, however, that the intermediate juice is sulphited and filtered, and that in the filtration of both this and the thin-juice "Hyflo" kieselguhr is used. Roots worked per hour amount to about 360 q.

Coal Consumption.—According to some French official figures recently published, the consumption of coal in the French beet factories during the 1926-27 campaign was 103 kg. (2 cwt.) per 1000 tons of roots. Some factories, of course, use considerably less than this figure, which indicates only the average, while in countries other than France the average figure will probably be lower, seeing that elsewhere the *raperie* (juice-extracting factory), know to be wasteful of steam, either does not exist, or is in use only to a limited extent.

An example of figures which are considerably lower is given by JOSEF JASKOLSKI, of Vyskov, Moravia.[1] In 1923 the average consumption of coal per 1000 kg. of roots (weighed on the "Chronos") was 69 kg. (152 lbs.); in 1924, after reconstructing the evaporating, vacuum pan, and heating systems, they used 47·8 kg. (about 105 lbs.) in a test which extended over 12 hours, and was controlled by two independent competent authorities. During the past three campaigns the figures were 4·9 kg.. 4·74 and 4·47 kg. (108, 104 and 98½ lbs.) respectively. The coal used had a value of 6820 to 7100 calories; and it should be pointed out that the factory under mention is electrically driven, excepting only the pumps.

De Vecchis Process.—The French expert, Mr. E. SAILLARD, recently visited the Sanguinetto factory, Italy, to examine the method of beet dehydration which is installed there. He gives a very full account of his observations,[2] which are favourable. There are two SCOTT dryers capable of dealing with 80 and 100 tons of roots, say a total of 200 tons per day. It is estimated that 100 kg. (2 cwt.) of fresh cossettes give about 22-25 kg. (48½ to 55 lbs.) of dried slices containing 6-8 per cent. of water, these weighing 200-300 kg. per cubic metre. There are 12 diffusers of 15 hl., 200 kg. of the dried slices being placed in each, and 135-140 litres of juice at 48-50° Brix. drawn off per 100 kg. of dried slices. In the exhausted slices there remains 0·2 to 0·3 per cent. of sugar per 100 kg. of fresh slices.

Clarification is carried out by adding milk-of-lime equivalent to 0·25 kg. of CaO per 100 kg. of fresh roots, raising the temperature to 80°C., maintaining this for ½ hour, and then adding superphosphate (double the weight of lime used). After mixing, the temperature is carried to 95°C., and the juice filtered through presses and mechanical filters. The scums in the filter-presses contain about 3·5 per cent. of sugar, and the quantity obtained is about 2 kg. per 100 kg. of fresh roots. There is no evaporating apparatus, and subsequent to boiling the work is conducted as in ordinary factories. Two jets of sugar are made, double centrifuging is practised, and the product of the factory is white sugar. The factory consumes 60 quintals of coal in 24 hours, the gases having 5·8 per cent. of CO_2; 5 per cent. of *mazout* (fuel oil) of 10,500 calories is used for the dryer, this being calculated on the fresh roots. The dried cossettes were found to give the following figures on analysis; polarization, 63·40; sugar (by CLERGET method), 62·8; reducing sugars, 0·89; and water, 8·10 per cent. The molasses gave: polarization, 47·24; sugar (CLERGET), 47.00; reducing sugars, 0·73 per cent.; saline quotient, 5·73; and true purity, 65·00.

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1928, 52, *No.* 35, 369-377.
[2] *Suppl. Circ. hebd. Comité Central des Fabr. Sucre*, 1928, No. 2075.

Appended to the paper are remarks by Mr. R. BOUCHON, in which he mentions that DE VECCHIS specially insists on the physical state of the cossettes obtained by his process of drying in the patented SCOTT apparatus. Such material has a vitreous appearance, is almost transparent, and is brittle. This condition is due to the fact that all the albuminoids and pectic substances are coagulated, which condition is termed "cornification" by the inventor. It permits of the extraction of the juice by lixiviation instead of by osmosis with diffusion. It also allows of the filtration of the juice without complicated clarification. Certainly the rendement (refined sugar per 100 tons of roots) obtained has not been of the same order as is obtained in France, but this is due to the quality of the Italian roots, the purity of which is always inferior, viz., 78 to 83°. It is, however, a fact of the greatest importance that there is neither formation of glucose nor destruction of sugar in the course of dehydration in the Sanguinetto factory with the drying apparatus employed.

Lime Salts Determination.—Titration with standardized soap solution is the method most used in beet sugar factories, being convenient and quick. That this determination, however, is not the simple procedure that is often assumed, and that it in fact requires the careful observation of several precautions, is shown in a study by Dr. O. SPENGLER and C. BRENDEL,[1] of the well-known Institute of the German Sugar Industry, of Berlin. It is made clear that if steps are not taken to avoid these sources of error, correct (or even approximately correct) results can not be expected.

In the first place, in regard to the preparation of the soap solution, it is best not to use ready-made soap (e.g., so-called Castile) but rather to combine the constituents of soap of known purity, in order thus to obtain a solution of constant quality. It is recommended that one should saponify pure olive oil with alcoholic potash, and directions are given for so doing, taken from a well-known German text-book.[2] This solution should be of such a concentration that 10 c.c. equals 0·01 grm. of CaO, as advised by PELLET, and the solution for standardizing this (to be found in many books), is made by dissolving 4·353 grm. of crystallized barium chloride in water, and making up to 1 litre. When titrating with the soap solution, it is a good thing to add a little ammonia, as this gives a much sharper end-point, while the foam persists longer. Since this addition affects the results, one must add the same amount of ammonia when standardizing as when carrying out an actual test, say three drops from the same pipette every time.

There are a number of conditions which may affect the test as applied to sugar factory products. For example, the extent to which the solution under test is diluted; the amount of CO_2 or other impurity present in the distilled water used for this dilution; the nature of the glass vessel used for the titration, that is to say its size, and its shape; and especially the presence of magnesium salts in the assay solution. Reaction of course has some effect, though it does not appear to matter much whether the temperature of titration is 15 or 20°C. In general the rule is to standardize with a solution corresponding as closely in composition as that to be tested. A different table is required, for example, for a juice that is correct for a syrup. Finally, one should check the amount of lime from time to time actually present in the liquids examined, precipitating as oxalate, and either weighing as such, which is quicker than weighing as CaO, or else titrating the oxalate precipitate with standard permanganate.

---

1 *Zeitsch. Ver. deut. Zuckerind.*, 1928, 175-189

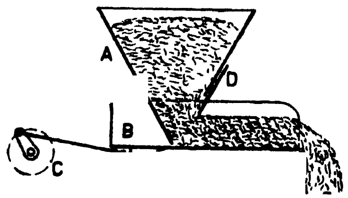
2 Frühling, 9th edition, page 549.

Java Technical Notes.

Following are brief summaries of papers on technical subjects recently appearing in our contemporary, the *Archief*. These abstracts indicate some of the excellent progress that is being made in Java in several important directions. It is proposed to continue from time to time these "Java Technical Notes."

TESTS WITH A NEW MECHANICAL BAGASSE STOKER. **E. C. von Pritzelwitz van der Horst, I. Hes and J. J. Spoelstra.** *Archief, Mededeelingen*, 1928, No. 16, 821-842.

After a short survey of the different systems of mechanical bagasse stokers,[1] which have either been tried, or are actually being used, a short description of a new design (apparently elaborated by the Experiment Station engineers), the main objective of which is the regular distribution of the fuel over the grate, is given with drawings. The principle of its operation is borrowed from a type of mechanical discharger of coal from bunkers. Referring to the sketch in which the idea is illustrated, the trough *B* makes a to-and-fro movement ; with each throw to the right bagasse is withdrawn from the hopper *A*, whilst when returning to the left, due to the weight of material above, the bagasse is forced out of the trough, falling below. Adjustment of the rate of to-and-fro movement, of the height of material in the hopper, and of the length of throw, enables one to obtain the feed desired. The apparatus has been in operation at the Gayam factory, where it is said to have given every satisfaction. It requires little attention, and improves the combustion, as indeed figures for CO_2, temperature, and steam production compared with hand stoking, show.



STEAMING TRIALS WITH PRE-HEATED AIR. **I. Hes and H. J. Spoelstra.** *Archief Mededeelingen*, 1928, No. 10, 535-562.

Using a system of discarded boiler tubes placed zig-zag manner in the first flue, it was found possible to raise the temperature of the air from 30 to 150 or 200°C., the heating surface of these tubes being only 13 per cent. of the actual boiler h.s. (whereas generally a much higher proportion is customary). The furnace was of the "Stork" type having an actual grate area of 6·62 sq. m. (70 sq. ft.), exclusive of the drying surface, while the boiler was a firetube of 300 sq. m. (3228 sq. ft.) h.s. As to the results, in general it was apparent that preheated air gave a higher boiler rating without any difficulty in working the installation. No great improvement in the CO_2 content of the gases (15 against 13·9 per cent.), nor in the excess of air (30 in place of 43 per cent.) was noticed, it is true, but on the whole the process of combustion was better. No troublesome clinker was formed, and no detrimental effect on the grate, walls, or boiler parts could be detected.

CENTRIFUGAL *vs.* PLUNGER PUMPS FOR THE FIRST PRESSES IN CARBONATATION FACTORIES. **C. W. P. van der Meijden.** *Archief*, 1928, **36**, II, No. 48, 1190-1198.

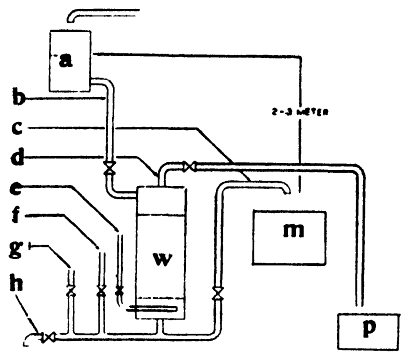
Tests showed carbonatated juice after passing through centrifugal pumps in a Java factory to have inferior filtering and subsiding qualities, as compared with the same juice before entering the same pumps. This difference was made clear by microscopical examination, the former being in a very regular but extremely fine state of subdivision, whereas the latter was in the form of

1 NOËL DEERR : "Cane Sugar," pages 466 and 467. Also LOCK, WIGNER and HARLAND : "Sugar Growing and Refining," page 132. *Sugar Cane*, October, 1892.

flocks. Plunger pumps are recommended instead on the ground that they do not affect the physical state of the precipitate. When they are used, 20 per cent. less lime can be added for the production of a sufficiently good cake, less scum thus resulting, so that less filtering surface, and less sweetening-off water are required. A lower pressure is another advantage.

Rapid Filtration of Sulphited Syrup through Sand. **G. J. T. Heyning.** *Archief*, 1928, **36**, II, No. 47, 1179-1182.

At the Dinoyo s.f. during the 1928 campaign an experimental sand-filter was erected with the object of finding a simple method of rapidly obtaining clear syrup for the pans in making white sugar In the sketch is illustrated the scheme which was successfully applied. As is seen, syrup from the evaporators was sent to a pressure tank, after which it was allowed to run through a depth of about 1 metre of European silver sand, the grains of which were about 2 mm. ($\frac{1}{12}$ in.) the 1 mm. size having been proved to impair too much the capacity of the filter. In putting the apparatus into use, it was necessary first to fill the filter from beneath in order to expel the air, this being done with clarified juice. This having been done, syrup was run in from the top, driving out the juice: and filtration of the syrup was allowed to proceed for four hours, when cleaning was necessary. Clarified juice was therefore again sent through the sand from beneath, all the scum being thus removed after a short time. Mr. Alewyn, of the Experiment Station, using a laboratory Laval centrifugal, found 0·029 and 0·005 per cent. of mud in the syrup before and after passage through the filter, so that the contents in solids had thus been reduced to about 17 per cent. of that present originally. As to the capacity of the filter, this was about 70 hectol. per sq. metre (or about 141 gall. per sq. ft.) per hour.



a, syrup storage tank; *b*, syrup inlet; *c*, syrup outlet; *d*, wash-water outlet; *e*, air vent; *f*, juice inlet; *g*, steam inlet; *h*, general outlet; *m*, filtrate storage tank; and *p*, wash-water storage tank.

Alkaline Defecation-Carbonatation Process of Clarification. **K. Douwesdekker and P. C. Nikola.** *Archief Mededeelingen*, 1928, No. **13**, 721-749.

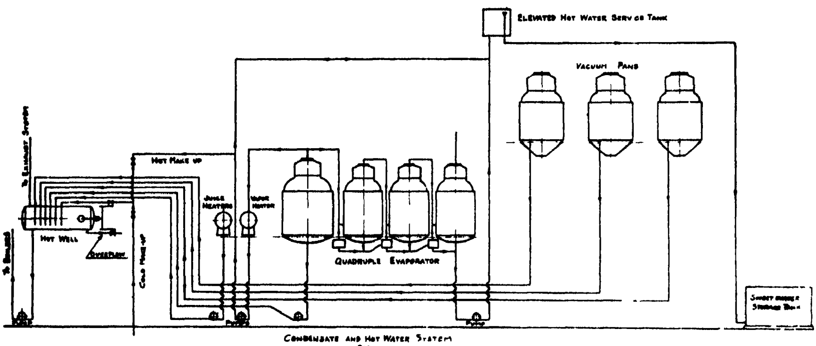
At the Djatiroto factory, Java, the Experiment Station have been conducting experiments on a new process of clarification in which a certain amount of lime is added to the cold juice to impart a slightly alkaline reaction to phenolphthalein, after which pure CO_2 is pumped in until an acidity corresponding to about 1000 mgrms. of CaO per litre is reached. This acid juice, the *pH* of which is about 6·7 (the lime being present as bicarbonate) is treated with the main quantity of lime so that the bicarbonate is thrown down as carbonate, the alkalinity then being 700 to 800 mgrms. of CaO per litre. After being allowed to settle, and after separating, both clear juice and mud are treated with CO_2, following which the clear juice is filtered, whilst the mud after being heated to 70°C. is allowed to settle for a second time, heated to 90°C., and again filtered; the filtrate and the second clear juice are lastly added to the acid juice just before the main quantity of lime is added. Clarification by this process is claimed to be better than is realized in sulphitation, while it is cheaper than ordinary carbonatation.

Condensate and Hot Water Systems.[1]

By G. W. CONNON.

The method practised for handling the condensate, as used in some of the better factories in Cuba, is known as the closed hot-well system, from the fact that the condensate is retained in a closed system, which is maintained under the same pressure as the exhaust steam. This prevents the loss of heat due to flash which always occurs when condensate is allowed to drop from a higher to a lower pressure, such as takes place when it is discharged to an open hot-well. The condensate produced by the condensation of live or exhaust steam from the juice-heaters, evaporators and vacuum pans is discharged to a closed vessel or hot-well, connected by means of a pipe to the exhaust steam system so that the hot-well is always under exhaust pressure. From the hot-well the condensate or water is pumped to the boilers. The condensate produced by the condensation of vapours ("sweet water") is discharged to storage tanks and is used when required for boiler feed make-up, maceration and general hot water service in the factory. A number of plantations in Cuba also use sweet-water for locomotive boiler feed.

Practically all of the factories in Cuba with which the writer is acquainted have only calandria vacuum pans, and use exhaust steam entirely in the boiling-house. If there is a shortage of exhaust, which is almost always the



Condensate and Hot Water System
For
Raw Sugar Factory

case, expecially in electric-driven factories, this shortage is made up either by the use of a live steam pre-evaporator, or live steam is by-passed to the exhaust, the amount being controlled by an automatic regulator which passes sufficient steam to maintain a constant exhaust pressure.

The diagram shows a typical arrangement of a condensate and hot water system for a gravity-type factory where the vacuum pans are at an elevation high enough to allow the condensate from the calandrias to flow direct to the hot-well. No traps or syphons are required. In factories where the vacuum pans are not arranged to permit a gravity flow, the condensate is discharged to a a receiver placed under the pans on the ground floor, from which it is pumped to the hot-well. In most factories the heaters and evaporators are not placed high enough for the condensate to flow direct to the hot-well, which makes it necessary to use pumps for this operation. The drips from the live steam lines are also discharged to the hot-well. For this purpose, it is best to use a three-valve Crane-tilt or other similar type of pumping trap.

The hot-well usually consists of a cylindrical vessel with humped heads built to withstand the exhaust steam pressure. Sometimes an old multi-

[1] Reproduced, slightly abridged, from the Report of the 1928 Meeting of the Association of Hawaiian Sugar Technologists.

tubular boiler, from which the tubes have been removed, is used. The hot-well is provided with the following fittings : Nozzles to which are connected the different condensate lines. A copper float with outside lever to operate a balanced valve on the make-up water line. Sufficient water is admitted to maintain a constant level in the hot-well, which is usually about 9 in. to 12 in. above the centre. The make-up water line is connected on the inside to spray pipes or pans in order to divide the water into fine sprays or streams so that it can be heated by the exhaust steam. The hot-well is vented to the exhaust steam system by means of a suitable pipe line to the exhaust so that there will be no danger of pressure being built up. This pipe also allows the flow of exhaust steam to the hot-well for heating the make-up water. An overflow should also be provided in case there should be an excess of water at any time. The overflow is sometimes placed at the bottom and is provided with a balanced valve which is operated by the same float that operates the make-up water valve.

Another method is to carry a pipe up to the overflow level, which pipe is connected outside the tank to a syphon. The following fittings are also provided :—Gauge glass to show the water level ; Safety valve ; Pressure gauge ; and Thermometer.

The hot-well has to be placed high enough to provide sufficient head so that there will be no trouble with the boiler feed pumps getting vapour bound and not taking the water. It should be covered with heat insulating material to prevent radiation of heat, and it is also advisable to insulate the condensate pipes. The temperature of the boiler feed from a closed hot-well should be very little below the temperature of the exhaust steam. For instance, if a back pressure of 6 lbs. is carried, the temperature of which is 230°F., the temperature of the boiler feed should be only a few degrees below this. Quite a common practice in some of the older type of factories is to discharge all of the mixed condensate to an open hot-well, the surplus water flowing to the sewer. The temperature of such water is usually about 180°F., or a difference of approximately 50° as compared with the closed hot-well system. Such an increase of temperature is equivalent to a saving of 4·5 per cent. in fuel, which is worth while. The Cuba Cane Sugar Corporation, which controls twelve factories, has adopted this system as a standard.

With the closed hot-well all of the cylinder oil in the exhaust steam which is not taken out by oil separators, and which enters the calandrias of the evaporators and pans finally reaches the closed hot-well and from there passes to the boilers, and has sometimes caused a considerable amount of trouble. All heating surfaces in the boiler-house should be protected from oil with an efficient separator in order to reduce to a minimum the amount of oil which reaches them. This should be done, if for nothing else than to protect the heating surface from fouling. There are oil separators on the market that are quite efficient, but there are none that will give a 100 per cent. separation. The use of anti-corrosive cylinder oil for lubricating engine and pump cylinders will permit the quantity of oil to be reduced anywhere from one-half to one-quarter of the quantity as compared with oils now commonly used. The manufacturers of this oil claim that it can be used as a boiler compound, and will not cause any trouble to the boilers. The writer knows from experience that where this oil is used, boiler troubles due to oil have disappeared.

There are now quite a number of factories in Cuba using such oil who find it gives very satisfactory service. It was first used in Cuba about eight or nine years ago, but only within the last two years has it come into any extensive use. It has been found extremely difficult to get the average engineer to

comprehend or believe that such oil has the characteristics claimed for it by the manufacturers.

Oil filters installed in the boiler feed line are used in many factories, and they have been found to be quite satisfactory if given careful attention. The writer, however, has found that in a number of places they have not been given the proper attention, with the result that after a short time they have been cut out and not used. The boiler feed-water should be tested daily by the laboratory personnel, and if found acid, sufficient caustic soda solution or milk-of-lime should be added to bring it back to neutrality. All condensate lines should be provided with a sewer connexion so that if there be leakage of sugar from any of the calandrias the water containing this sugar may be easily turned into the sewer.

The condensate produced by the condensation of vapours which come from vapour heaters and second, third and fourth cells of the evaporator is usually collected and pumped from the last cell. In some cases this water is pumped directly to an elevated hot water service tank placed high enough to provide sufficient pressure for boiler feed make-up, maceration water supply, etc., the excess water overflowing to a large storage tank from which it is drawn during the shut-down periods. Some factories pump this water directly to the storage tanks and use a general hot-water service pump to furnish water under pressure for the factory. The advantage of the closed hot-well system is that the heat lost is small, especially if the hot well and condensate pipes are well insulated, resulting in the boiler feed being always at a maximum temperature. There are yet quite a good many engineers, if we are to judge by the crude way condensate is handled in some fatories, who do not realize the loss of heat or fuel caused by not utilizing the condensate efficiently.

Correspondence.

"JAVA versus CUBA"

TO THE EDITOR OF "THE INTERNATIONAL SUGAR JOURNAL."

SIR,—I note in your January issue a letter addressed to you by Mr. G. A. P. Weyer, in which reference is made to a remark in my Market Review *re* Java.

The report of a distribution by a certain Java sugar concern of dividends to its shareholders in excess of 90 per cent. was at the time going the round of several organs of the sugar press. I referred to it only as a confirmation of the well-known fact that the Java factories are financially very soundly situated. I attributed the exceptionally favourable financial state of the Java factories to a high level of technique in the factories and of agriculture in the fields, as well as to comparatively cheap labour. We are indebted to your correspondent for a third reason, namely, the accumulation of assets in the hands of Java sugar companies.

It goes without saying that if the latter are wealthy enough to run factories without loans from Banks, having at their disposal accumulated reserves of old profits in addition to the capital, they are naturally capable of dealing more efficiently with the producing and marketing of sugar.

I see nothing in my observations which contradicts the point of view advanced by your correspondent.

Yours faithfully,

M. GOLODETZ.

Publications Received.

Sugar Beet in France, Belgium, and Holland. A. Bridges and R. N. Dixey. (Clarendon Press, Oxford). 1928. Price : 4s. 6d.

In what respects Continental beet practice differs from our own, that is, the factors that exist there and are possible or impossible of reproduction here, is the theme of this excellent small book, the result of three short tours made by the authors in Belgium, Holland and Germany in 1926 and 1927. First, it is made clear in its pages that labour conditions are altogether different. There the peasant proprietor exists with his frugal standards of living and his industrious habits, and the cheap and efficient type of worker. Secondly, there can be no doubt that the Continental beet crop owes its continued existence in no small measure to the full use made of the tops and leaves and of the pulp. Thirdly, figures are adduced showing that the crop in the three countries mentioned is obtained at a cheaper cost than here, where in fact the yields are at present seriously less. In fact the view is expressed that " it remains open to doubt whether yields in this country can ever reach the same average level as do foreign yields, for the reason that the areas of soil here which compare for suitability for beet-growing with those on the Continent are extremely limited in extent. . . . . That particular combination of clay, lime and humus which comprises so much of the foreign beet fields can probably be found in this country in very few places." Another aspect is that " the machinery by which the Continental grower is assured of obtaining the right price is more adequate than that found in this country. First, by means of district, as opposed to national agreements, prices can be adjusted to varying local conditions ; and secondly it is the rule rather than the exception for the grower to share in the effects of varying prosperity in the industry." Much valuable data are given on yields, cost and returns and by-products. The book is certainly one to be read and studied by those concerned with our beet industry.

Analytical Chemistry. Based on the text of F. P. Treadwell ; translated, enlarged and revised by Wm. T. Hall. Volume II ; Quantitative Analysis. Seventh Edition. (Chapman & Hall, Ltd., London). 1928. Price : 25s. net.

Sugar chemists desiring a thoroughly reliable guide to analytical practice will find it in this volume of " Treadwell," which is indeed a standard work of its kind. In the introduction it gives instructions in general manipulations, weighing, and the filtration, washing, drying, and igniting of precipitates, sampling, the preparation of the substance for analysis, etc. Part I deals with the gravimetric determination of the metals and metalloids ; Part II with volumetric analysis, including precipitation analyses ; and Part III with gas analysis. Various tables giving data of important compounds, factors for calculating analyses, logarithms, etc., complete the volume. It is now in its seventh edition, having been the aid so far of some generations of students, and a better and more trustworthy textbook of analytical chemistry could hardly be found.

Practical Bacteriology : An Introduction to Bacteriological Technique. Fred W. Tanner. (Chapman & Hall, Ltd., London). 1928. Price ; 12s. 6d.

One is asked from time to time to recommend a textbook of bacteriology for the use of those in the sugar industry, and especially those connected with distillery work, who desire to make acquaintance with the subject. Here is a volume which the reviewer would put forward without hesitation. It is a laboratory guide to the technique of the subject, and the student working through it should acquire a great amount of information on general apparatus and procedures, on the microscope and its use, on culture media, on the examination and isolation of bacteria, and on the study of yeasts and moulds. It is well illustrated, its numerous figures showing, in addition to the more important apparatus used, some useful laboratory charts of colonies, streak and stab cultures, etc. A plan of work, giving an arrangement by which the book may be adapted to a course, is another practical feature of the book.

Brevities.

CITRIC ACID is being manufactured, it is stated, extensively in the United States by a fermentation process, using the mould known as *Aspergillus niger* with sterile sucrose solution containing certain nutrient salts.

CAUSTIC POTASH AND CAUSTIC SODA for analytical purposes, it is of interest to chemists to note, are now being made in small pellets, a much more convenient form than sticks.

WASTE WATERS from tropical distilleries are often allowed to discharge into a stream or pond, where they undergo a type of fermentation, which may be very objectionable and in some circumstances may constitute a danger to health. Modern methods of treating such distillery effluents have now been devised by which, using a plant which is not costly and is convenient to operate, the fermentation may so be controlled that an odourless and harmless water is produced. This water may then be discharged into a stream, or may be sent over the land, or may be otherwise utilized, without danger of any objectionable or unhealthy consequences.

In a paper on CHEMISTRY AND THE CANNING INDUSTRY, W. D. Bigelow[1] has some remarks on spore-resisting bacteria and their rôle, stating: "Considerable work has also been done in bacteriological field surveys in which the sources of these spoilage bacteria have been studied.[2] Sugar has been found to be the chief source. Even the refined granulated sugar used in the industry may carry the spores of these spoilage bacteria."

PURIFYING MOLASSES.—T. G. y Arnal, of Madrid University,[3] has studied experimentally the possibility of precipitating the alkali salts of final molasses, so as to make it possible to recover a further amount of sugar by crystallization. He obtains the compound $CaK_2Fe(CN)_6$, the solubility of which is 0·34 per cent., the reagent being recovered from the precipitate by treating, say, with ferric sulphate. In this way, it is claimed 62 per cent. of the sucrose can be recovered from molasses otherwise exhausted. This worker, however, ignores the toxic nature of the ferrocyanide reagent he proposes to apply.

SOIL FUMIGANTS are recommended by the Bureau of Sugar Experiment Stations, Queensland, for cane grubs. Para di-chlor-benzene has the property of giving off toxic vapours for a considerable time, a distinct advantage in dealing with scarabaeid grubs which remain in the second stage through the winter and assume their third stage in the spring. Carbon bi-sulphide (injected into the soil), while acting quicker than para-dichlor, does not possess the property of remaining toxic over a number of days, and therefore would fail to kill those grubs which rise towards the surface subsequent to the act of fumigation. Towards December, however, when the soil is moist and when the grubs are for the most part found feeding near its surface, then the CS_2 is to be recommended.[4]

"SUMAPHOS" is a particularly valuable clarifier, states the manager of one of the largest *uzinas* in Pernambuco who writes as follows: "Last week we passed through a *periodo critico*, when after a considerable spell of dry weather with the cane vigorously ripening there followed heavy rains. Juice from the mills was to say the least of it refractory, the quantity of *cachaca* being enormous and of a clinging gummy nature, so much so that juice-heaters and evaporators became plugged up . . . . . . Fortunately the "Sumaphos" ordered arrived in time, and was immediately applied with such good results that the wood consumption which had risen to 10 per cent. of the cane was lowered after the usual Sunday cleaning to 4 per cent. We are using "Sumaphos" at the rate of 300 grms. p.t.c., and are producing beautiful defecated juices with the final m.-c. curing like the first. Our exhausted molasses is going to the distillery with an apparent Q.P. of 26 with normal juice at 79·5°. In my opinion there is nothing to touch this product as an aid to eliminating impurities and producing a good plantation white. In fact even in the manufacture of so-called "Demeraras" (or 96-test sugar) it is of the greatest assistance in recovering the sucrose presented by the mills to the fabrication."

[1] *Ind. & Eng., Chem.*, 1928, 20, No. 12, 1286-1289.
[2] CAMERON, WILLIAMS and THOMPSON: *National Canners' Association Bulletin No.* 25-L (1928).
[3] *Chimie et Industrie*, 1928, **20**, 27-28. U.K. Patent, 297,482.
[4] *Report of the Southern Assist. Entomologist, Bureau of Sugar Experiment Stations, Queensland.*

Brevities.

Glucose from Potatoes.—The Victorian Government has acquired the manufacturing unit of a plant with which to convert the annual heavy surplus of potatoes into glucose and starch. Mr. O. A. Mendelsohn was commissioned by the Government to investigate this manufacture as carried out in England, the Continent, and America.

In a French agricultural paper[1] are given some figures relating to Beet Cultivation Costs. An enquiry is said to have shown that the total costs of cultivation of beet in that country amount to 5500 to 6000 fr. per hectare (2·47 acres). Calculating with a beet price of 180 to 195 fr. per metric ton of beets, and a yield of 24 to 25 tons per hectare, the nett monetary receipts per hectare are 4420 to 4875 fr., that is much less than the costs of cultivation. It is true that the value of pulp is not taken into consideration, nor that of the tops and leaves, and that the tonnage is rather too low, but nevertheless it would appear from these figures if they are average ones that beet cultivation is not an attractive proposition in France.

Sugar as Medicine.—Dr. Baronsfeather recommends[2] Demerara sugar in phthisis, claiming to have proved that this sugar is superior to others for the purpose indicated. In influenza, colds, heart cases, lung cases, and for delicate children, he uses the following prescription : One or two teaspoonfuls of Demerara sugar dissolved in a small glass of hot water, to which is added either half to one teaspoonful of tincture of ammoniated quinine or, in heart cases, the same amount of sal volatile. The effect is attributed rather to the sugar, and he claims to have obtained superior results with Demerara than with other grades on the market, adding further that taken in the winter the mixture of sugar and quinine is an excellent preventive of colds[1].

Malaria Specific.—Observations were made recently in the Philippines of 90 cases of malarial infection by means of Plasmoquine,[3] regarding which some notes have already been made.[4] Forty, all tertian infections, were freed from parasites in from 2-6 days after treatment began ; 31, simple aestivo-autumnal infections, were freed in 2-10 days ; and the remainder, double infections, do not appear to have given such satisfactory results, though in all cases, most pronounced in 85, splenic enlargement rapidly decreased. Relapses were exceptionally few, compared with quinine medication. On the whole, however, the opinion formed was that plasmoquine should be regarded as the first of a new series of anti-malarial synthetic drugs, and not as the climax of what has already been accomplished. The future regarding the synthesis of a still more efficient antimalaric compound is distinctly hopeful. A similar conclusion has been reached as the result of the observations of the United Fruit Co.[5]

"The Chemist in the cane sugar factory aids the engineer on the one hand, the sugar boiler on the other.[6] He calculates the fuel value of bagasse, and furnishes the formulae for burning the different grades of bagasse derived from canes of different ages and varieties. He analyses feed waters, and supplies the formulae for compounds counteracting the impurities. He conducts dry crushing tests, to determine the efficiency of the individual units ; thus discovering faults which when corrected enhance the efficiency of the plant as a whole. His constant researches tend toward the solution of problems confronting every department in the mill. He is indispensable, too, in the keeping of the sucrose books ; here he is depended upon to trace losses to their source and eliminate them. Upon his reports are made the distribution of sugar to the producers whose cane is handled at his mill. Each producer is anxious for as large a return as possible, and the chemist's tally must be a fair one. In short, the chemist in the cane sugar factory, ever seeking means for reducing production costs, must not only keep abreast of what is in actual operation, but a step or two ahead."

---

1 *Action Agricole.* 2 *The Lancet.*

3 C. M. Hasselmann and Margarethe Hasselmann-Kahlert : *The Philippine Journal of Science*, 1928, 37, No. 1, 75-119.

4 *I.S.J.*, 1927, 11, 84.

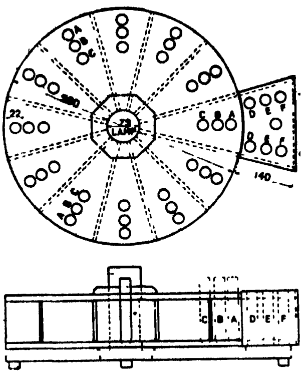
5 United Fruit Co., Medical Dept. Reports 15 and 16.

6 Theo. Nickelsen, Reports of the 6th Annual Convention of the Philippine Sugar Association.

Review of Current Technical Literature.

Determination of the Degree of Acidity in Sulphitation Factories, using the *pH* Value. **M. den Hartogh.** *Archief*, 1928, **36**, II, No. 47, 1175-1179.

With the popularizing of *pH* determinations in the sugar factory, it has been found that the method is not only more exact in giving the true degree of acidity or of alkalinity, but, provided it is properly carried out, is also more convenient in its operation. In raw juice sulphitation the workman can use cresol red (C.R.) solely as his indicator, the transition from yellow to red (7·2-8·8) being a definite one. Para-alpha-naphtholphthalein (P.A.N.) can also be used, but in practice it is a troublesome indicator, as one must become accustomed to its colours, reddish yellow to blue (7·3-8·7), and also as its change is affected by the natural colour of the juice being examined, especially by artificial light. In making a test with cresol red, the sulphiter fills the depressions of his porcelain spotting plate with five drops of juice, and to one of them adds a drop of the indicator, which up to a *pH* of 7·8 will give a bright red coloration. At *pH* 7·5-7·4 this is a lighter red; whilst at 7·2 and below the addition of the indicator is without result, so that the SO_2 valve can then be shut off, the desired *pH* of 7·1-7·2 having then been reached. In taking the *pH* of the subsided juice, 10 c.c. are pipetted into a test-tube, and a few drops of B.T.B. added, when a bright green colour should be obtained at the optimum *pH* of 7·1-7·2, or a moss green, if the natural colour of the juice is rather dark. In examining condensates and boiler waters for *pH* according to the Gillespie method, the author makes use of the apparatus shown in the sketch, which consists of a rotating disc adapted to contain various tubes. In the *A* and *B* openings are placed tubes containing buffer solutions and indicators on the acid and the alkaline sides, whilst in *C* are placed the tubes containing the liquid under examination without any indicator. A daylight lamp is used, and on the right there is a fixed part containing holes marked *D*, *E*, *F*. *D* taking a tube containing the liquid to be examined plus 10 drops of B.T.B., or B.C.P. according to the *pH* to be expected, whilst in *E* and *F* are tubes containing only water. Now, standing before the apparatus and looking into the small openings *G*, *H*, *I*, one rotates the disc until *G* has a colour corresponding to *H* (*G* and *I* are always the same), and then the corresponding *pH* is read. This apparatus can be applied to general *pH* determinations very conveniently. Lastly, the author mentions that in sulphiting syrup one may control it by means of chlorphenol red having a range from 5·0 to 6·6 (yellow to violet-red), the spotting plate method giving with a pale rose tint a *pH* from 5·3-5·5. (The numbers shown in the sketch above indicate measurements in millimetres.)



A Study of the Refining Qualities of Raw Sugars. **Pedro Sengson.**[2] *Sugar News*, 1928, **9**, No. 11, 807-811.

In order to know more of the actual value of Philippine sugars, the writer made an extensive study of their refining qualities,[3] the work covering a period of four years beginning with the 1924-1925 crop and the samples used in the tests representing a total of 360,874 tons of sugar. From the results, one can readily see that while much has been done heretofore toward improving the sugar during the last four years, there is still great room left for further improvements. Apparently the figures show conclusively that it is not impossible to make "good" sugar if those responsible take great care during the entire manufacturing operation. Very little change was made in the polarization of the sugars, being 96·85 per cent.

[2] Chief Chemist, Bacolod-Murcia Milling Co., P.I.
[3] See also on this subject, *I.S.J.* 1928, 34, 43, 332, 557.

in 1924-1925; 96·68 per cent. in 1925-1926; 96·78 per cent. in 1926-1927; and 96·78 per cent in 1927-1928. While it is admittedly a good plan to make sugar of high polarization, yet with the present sales contract with the refiners, it is not advisable to do so without incurring unnecessary losses. On the other hand, it would be equally impracticable to make sugar polarizing below 96·5° without materially affecting adversely its quality. For the present it would be best to keep the polarization between 96·5° and 97·0°. Moisture has been considerably reduced, the reduction having been effected every year as follows; 1·084 per cent. in 1924-1925; 1·010 per cent. in 1925-1926; 0·843 per cent. in 1926-1927; and 0·785 per cent. in 1927-1928, making thereby a corresponding reduction in the "deterioration factors" of 0·344, 0·305, 0·263, and 0·244 respectively. These figures show among other things that sugar of better keeping quality than in previous years has been made, a step in the right direction. Ash represents the inorganic impurities of sugar, mostly found incorporated with the molasses film surrounding the sugar crystal proper. The amount of ash diminished slightly, being 0·29 per cent., 0·305 per cent. 0·291 per cent., and 0·246 per cent. for the last four years respectively. These figures represent carbonated ash obtained by direct incineration. The measurement of clarity (or turbidity) consists in the determination of the height of liquid expressed in millimetres through which light can pass without being totally absorbed, the apparatus used by the writer in this case being the Kopke "Turbidimeter." The results showed a great and steady increase in the clarity of the sugars. The test is important from the standpoint of the raw sugar manufacturer, in that it helps him check the accuracy and quality of the work in the clarification department with great ease and in comparatively short period of time. While clarity figures are significant in the writer's experience there is no definite relationship existing between clarity and filtration rate as most people erroneously believe.

Filtration rate is one of the most important characteristics which determine the quality of sugar for refining purposes. In carrying out this test the author used the Elliot Filtration Apparatus which proved to be handy for the purpose, the standard used being 4400 grms., which is about the average maximum filtration rate of a number of different brands of refined and cube sugars. The results show that Philippine sugars are really "poor" in filtrability, which results were corroborated by similar results obtained in actual refinery practice. The filtration rate remained practically the same as in 1924, which shows that perhaps very little or no attention was paid to such an important characteristic so strongly demanded by the refinery. Experience has shown that under normal clarification, colloids impeding filtration cannot all be removed from sugar solutions. Under this condition it would be necessary to further reduce their quantity by a system of sugar boiling which would bring down to a minimum the circulation of these impurities within the boiling house. For this purpose the two-boiling system may prove effective. There was a remarkable decrease in colour, exception, however, being made for sugar of crop 1925-1926 which was found to contain an average of 80·5 per cent., the highest ever recorded during the four-year period. But the colour of the original sugar is not as important as the colour within the crystals. It is the latter that counts, and the less of such colour the better. Unfortunately sugar from crop 1927-1928 was found to contain more of the objectionable colour within the crystals than that made the previous year. One of the outstanding accomplishments in Philippine manufacture is that pertaining to the cleanliness of the sugar. This was made possible by the practice of straining the juices and syrups through metal cloths of fine meshes. A very remarkable improvement has been effected in the size of grains, the percentage of "total small" having been reduced from 54·11 per cent. in 1924-1925 to 38·71 per cent. in 1925-1926, to 26·31 per cent. in 1926-1927, and to 23·10 per cent. in 1927-1928, compared to standard refinery requirements of 25 per cent. By "total small" is meant all grains having diameters ranging from 0·15 mm. to 0·60 mm. Small grains always give much trouble on washing. A sugar to be considered "good" with respect to the size of its grain must contain a minimum percentage of "total small" irrespective of the amounts of "very large" or "large" grains. Thus a sugar containing the most "medium" sized grains and the least "total small" is far

better than one having a majority of "very large" or "large" grains but with "total small" in excess of 25 per cent. For it is the quantity of the "total small" that has a direct relation to the success of affination, the latter being in inverse proportion to the former.

PROPOSED MODIFICATION OF THE JAVA SULPHITATION METHOD. **H. H. E. Sussbach.** *Archief*, 1928, **36**, II, No. 48, 1187-1189.

In closely studying the defecation-sulphitation method of juice clarification, the question arises whether one can remove a greater amount of the non-sugars without any great change in the installation, in order thus to obtain a better thin-juice and also obtain a more easily handled scum. At present the method of working most followed consists in heating the raw juice to about 70°C., in liming and sulphiting approximately simultaneously, at a slightly alkaline reaction, and to finish sulphitation at a final alkalinity lying between 7·4 and 7·8 *pH*, after which the juice is re-heated to about 104°C., and sent into the settling tanks. Now one would expect from the high temperature combined with the slightly alkaline reaction to have as complete a flocculation of the colloids as is possible and a scum of good physical qualities, making it easily filtrable. But the thin-juice thus obtained is actually inferior to that obtained by carbonatation, which is to be ascribed to the less amount of the purifying agent used, namely lime. And one must not lose sight of the fact that the sulphitation method of clarification, in respect of the flocculation of the colloids, is carried out under totally different and much inferior conditions to those obtaining in carbonatation. Whereas in carbonatation the reaction is strongly alkaline at first, it is never so in sulphitation; and it is known that an important group of colloids only flocculate at a very strong alkalinity, of which use is made to advantage in the De Haan process.

In the ordinary method of sulphitation in which a thin stream of milk-of-lime reaches only to the uppermost layers of the juice, very probably leaving the lowest layers much less alkaline if not indeed acid (due to the SO_2 entering from beneath), and in which moreover the time during which this reaction persists is very short, it is hardly possible to expect an effect similar to that in carbonatation. In some factories in which the dose of lime is added in two separate additions some improvement is effected. Since, however, in all juice clarification one has not so much to do with ion reactions as with physical-chemical processes which operate slowly, one must expect to maintain the alkaline reaction for some time, in which connexion it may be mentioned that in the De Haan method the alkaline reaction lasts for some minutes. The permissible temperature at which an alkaline juice may be sulphited is 55-60°C., this corresponding with that to be maintained in carbonatation in order to avoid glucose decomposition, and at this temperature a group of colloids, which otherwise would remain quite unaffected, can be thrown down with a strong alkalinity. In practice the necessary amount of lime must be known. If 3 litres of 15°Bé. milk per 1000 litres of raw juice represents the average amount for neutralization, then in order to have an alkalinity corresponding with that in the De Haan method (250 mgrms. CaO per litre) one must add about 5 litres of 15° Bé. milk per 1000 litres. Then after this addition, seeing that the colloids are not immediately affected, the juice must be left for 5 minutes at 55°C., after which, while gradually running in the remaining milk, the juice is sulphited off. Theoretically, a better clarification should thus be obtained with a better subsiding and a minimum glucose decomposition. Investigations on this method have been carried out by the author in the laboratory, and, later, on the technical scale, though, it is remarked, it is not new in principle, seeing that it or a similar procedure has been carried out at the Bandjardawa factory. It has been found that the resulting juices are clearer and the colour lighter than usual, besides which the after working was easier, and the colour of the massecuites better. The number of mgrms. of CaO per litre of clarified juice was low for sulphited juices, namely about 400.

ON THE POWER TRANSMISSION BY BELTS. **H. W. Swift.** *Paper contributed to the Institution of Mechanical Engineers*, November 16th, 1928. An attempt has

been made here to review the problem of the belt drive from its foundations and to show that a general theory, developed logically from the established laws of mechanics, gives results which agree with tests made under running conditions and are consistent with the proved facts of practical experience. In order to separate the numerous factors which have a more or less important influence on the conditions of running, the treatment, both theoretical and experimental, is for present purposes confined to what may be regarded as basic conditions, where such effects as centrifugal force and want of flexibility in the belt may be neglected, and consideration is chiefly given to open drives between pulleys of equal size.—SOLUTIONS : SUGAR. **T. M. Lowry.** *Chemistry and Industry*, 1928, **47**, No. 47, 1233-1235. "The existence of hydrates of cane sugar cannot be demonstrated by the simple process of freezing them out from aqueous solutions of the sugar, since sucrose always separates from water in an anhydrous form. Their existence in solution has, however, been indicated in other ways. Thus H. C. JONES[1] from measurements of the freezing points of aqueous solutions of chloral hydrate and cane sugar calculated that the average number of water molecules associated with one molecule of cane sugar is between 5 and 8. In the same way J. C. PHILIP[2] by comparing the solubility of hydrogen in aqueous solutions of chloral hydrate and of cane sugar calculated that the "average molecular hydration" of the sugar was about 6. In this way the high solubility of sugar in water is explained.—INVESTIGATION INTO THE FUEL VALUES OF BAGASSE AND WOOD FUELS. **N. Craig.** *La Revue Agricole*, 1928, No. 41, 228-231. Samples of bagasse taken from six Mauritius factories were found to have the following values (stated in cals. per kg., gross, no allowance for sulphur in the fuel nor for nitric acid formed), the other two figures given being the sugar and water content : 2481, 4·86, 50 ; 3138, 4·05, 40 ; 2451, 4·6, 52 ; 2670, 3·76, 44 ; 2667, 2·4, 44 ; and 2622, 2·24, 46. Samples of various Mauritius cane fibres gave values varying between 4381 and 4796 cals. (dry material); and various woods from 3938 to 4394 cals. (material containing 10 per cent. of water).—DETERMINATION OF H.I.C. AND ITS APPLICATION. **J. A. Kucharenko and B. G. Savinov.** *Monograph issued by the Sugar Experiment Station, Kiev, Ukraine.* In the summary given to this excellent publication, one reads that the application of *pH* determination in sugar manufacture is not merely desirable but actually necessary, seeing that inversion, coloration, adsorption, coagulation, surface tension, rate of filtration, and other important phenomena, are dependent largely on the hydrogen ion concentration of the liquids concerned. Ordinary titration is inapplicable. But many questions have to be studied more thoroughly, e.g., the effect of the dilution and of the temperature, the choice of the best indicators and the best modifications for each particular case, and the investigtion of sources of error. Often authors' conclusions are contradictory, and there yet remains much to be done in this new field.—CARBON TETRACHLORIDE FOR JUICE CLARIFICATION. **E. M. Gross.** *Reports of the Sixth Annual Convention of the Philippine Sugar Association*, 1928, 97. After laboratory tests the writer suggests that the raw juice should be scrubbed with carbon tetrachloride, left to repose for 15-20 min., and the juices drawn off for the usual run through the mill. This treatment, it is claimed, dissolves out the gums, and gives a better result in the settling tanks and facilitates filtration. In practice the use of the CCl_4 would be repeated until one ton of juice has been treated by 100 litres (22 gallons), after which it would be re-distilled and the gums recovered, the loss in each distillation being calculated to be 5 per cent.—GLUTOSE CONTENT OF MOLASSES. **H. I. Waterman and J. A. v. d. Linde.** *Archief*, 1928, **36**, II, No. 46, 1151-1155. Previous work is continued.[3] Molasses from nine carbonatation factories in Java (1927 season) showed glutose contents (per 100 of dry substance by desiccation) from 8·4 to 11·1 ; from a defecation factory in Java (1926), 6·8 ; from two sulphitation factories in Java, 10·5 and 10·9 ; from a Surinam defecation factory 6·8 ; and from a European beet factory, 1·4. That glutose is actually formed during juice clarification has been proved by the authors in laboratory tests with artificial juices, operating both carbonatation and sulphitation, this formation being favoured by a high temperature and high *pH*. Assume in Java 482,000 tons of molasses are

[1] *Amer. Chem. J.*, 1904, **32**, 319. [2] *Trans. Faraday Soc.*, 1907, **3**, 140. [3] *I.S.J.*, 1927, 169.

used for alcohol production,[1] and that its glutose content is 7·5 per cent., then this means that the actual loss in money due to the conversion of the fermentable into unfermentable sugars is about 500,000 Dutch florins (£141,322). Whether glutose is naturally present in cane juice and the conditions under which it is formed during manufacture are questions urgently requiring investigation.—METHODS FOR THE EXAMINATION OF KIESELGUHR. **M. Van de Kreke.** *Archief*, 1928, III, *Mededeelingen No.* 20. Directions are given for the determination of : Water, loss on ignition, insoluble in HCl, SiO_2 soluble in HCl (1 : 1), Fe_2O_3 + Al_2O_3, Fe_2O_3, and SO_4—H.I.C. INDICATORS USED IN JAVA. **P. Honig.** *Archief, Korte Mededeelingen No.* 11. In carrying out *pH* determinations in Java, they use the dropping plate method with a colour chart,[2] the indicators for the different products being the following : limed juice, bromthymolblue(BTB), 6·2-7·8 ; sulphited juice, bromphenolred (BPR), 5·2-7·2, or BTB. and para-alphanaptholphthalein (PAN), 7·3-9·0 ; second carbonatation juice, thymolblue (TB), 8·2-9·2 ; syrup from the evaporators, BPR and BTB ; and the first clear syrup, BPR and BTB. It is not permissible, of course, to use the hourly samples or any composite sample for *pH* tests, but freshly drawn samples only.—COMPOSITION OF PHILIPPINE SUGARS. **Delfin J. Suerte.** *Philippine Agr.*, 1928, 17, 149-151. Sample representing 265,727 tons or 56 per cent. of the 1926-27 crop gave the following results: Polarization 96·66,° gums 0·61, suspended solids, 0·10, moisture, 0·87 and ash, 0·30 per cent. The latter contained Al_2O_3 + Fe_2O_3 0·86 ± 0·01, P_2O_5 4·58 ± 0·04, CaO 8·58 ± 0·04, MgO 3·10 ± 0·05 and K_2O 48·86 ± 0·06 per cent.—RAPID DETERMINATION OF RENDEMENT IN CONTROLLING THE TIME OF CURING (USING THE ELECTRICAL ASH METHOD). **V. Netuka.** *Zeitsch. Zuckerind. Czechoslov.*, 1928, **53**, No. 11, 134-136. To control the curing of raw sugar so that it shall have a rendement value as near 88° as possible (thus avoiding any deduction of price) an average sample from the first centrifugal is examined as follows : 26·00 grms. are made up to 200 c.c., its polarization quickly determined after defecation with dry lead, its ash found from its conductivity, and the rendement read from a table. This can be done within 10 min., and an indication thus obtained of the time necessary to spin the remaining machines. Without such control (judging only from the colour of the masse) the rendement may vary between 86·4 and 90·5, but with it the variation is only 88·3 and 89·3.—ELECTRICAL DETERMINATION OF THE END-POINT IN THE FIRST CARBONATATION. **Vl. Stanek and K. Sandera.** *Zeitsch. Zuckerind. Czechoslov.*, 1928, **53**, No. 11, 129-133. Previously these authors have shown that there exists a relationship between the alkalinity and the conductivity of the juice undergoing carbonatation,[4] and the latter has constructed an apparatus for conductivity measurements with optical indication.[3] In this article they give further details of their method, which depends for its indications on the relative illuminations of two lamps. That of the first is by a current flowing through the juice to be measured, whilst the other is lit by the same current with the interposition of a rheostat. Therefore by previously adjusting the rheostat, so as to indicate the alkalinity to which the carbonatation is to be carried, one can see when the reaction has reached the end-point by visual comparison of the two lamps. It is said that the average experimental error amounts only to 0·003 per cent. CaO and the maximum to 0·007.—DETECTION AND DETERMINATION OF SUCROSE BY THE MOLYBDATE METHOD. **N. W. Matthews.** *Chemist-Analyst*, 1928, **17**, 8. Solutions of sucrose of the order of 1 in 1000 to 1 in 40,000 may be determined by the addition to 5 c.c. of the sample of three drops of concentrated HCl and 3 c.c. of a 4 per cent. solution of ammonium molybdate. The mixture is heated in boiling water for 6 mins., and the blue colour which is produced is matched against that of a suitable standard prepared under the same conditions. Such standards may be made up with Fehling's solution or blue-black ink suitably diluted. This should be a method worth examining in connexion with the determination of sugar in condensed water or in sweet-waters. J. P. O

---

1 About 73 per cent. of the total production.

2 Bulletin No. 11, Java Experiment Station, 4th Edition, page 36, *Archief*, 1927, I, 649 ; *Ibid.*, 1927, III, 676.

3 *Zeitsch. Z. C.*, 1927-28, 51, 209.

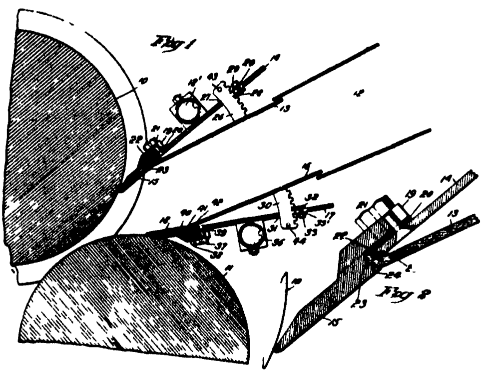
4 *Ibid.*, 1926-27, 51, 205, 603.

Review of Recent Patents.[1]

UNITED STATES.

INTERMEDIATE CHUTE FOR CANE MILLS. **Robert W. Sharp**, of Baton Rouge, Louisiana, U.S.A. 1,673,921. June 19th, 1928.

This invention consists in a novel construction of the end portion of the chute embodying an adjustable top feed plate, and also, if desired, an adjustable bottom feed plate, and an adjustable upper or scraper plate carrying a scraper toe to engage the upper roller of the mill and also, if desired, an adjustable lower or scraper plate carrying a scraper toe to engage the lower adjacent roller of the mill. Referring to the drawings, 10 designates an upper roller, 11 one of the lower rollers, 12 a portion of the main body of the chute through which the blanket is delivered to the succeeding mill, 13 the upper feed-plate, 14 the upper scraper plate carrying the scraper toe 15 in engagement with the upper roller, 16 the bottom feed plate, 17 the lower scraper plate and 18 the scraper toe carried by the plate 17 to engage the roller 11. The invention resides in the plates 13, 14, 16, 17 and features connected therewith, the rollers of the mill and the body 12 of the chute being of any usual or suitable construction. The top feed plate 13 constitutes a portion of the chute 12, but is independent thereof to the extent that while remaining a portion of the chute, it may be adjusted with relation to the bottom feed plate 15 whether said bottom plate is always stationary or provided with means for its adjustment. The upper scraper plate 14 is a flat plate about equal in dimensions with the plate 13, and said two plates diverge upwardly from each other. The plate 14 has bolted to its lower edge portion the semi-steel scraper toe 15, which inclines downwardly toward and engages the roller 10, and said plate 14 is supported from a transverse beam 18 which is swivelled in the side frames of the mill or parts connected therewith and is stationary except that it permits the plate 14 to be adjusted as to its inclination so as to carry the toe 15 against the roller 10. The toe 15 is of considerable body, and its upper portion 19 lies over the lower edge of the plate 14, and between said portion 19 of the toe 15 and the plate 14 there is interposed a steel liner 20. The bolts 21 securing the toe 15 and the lower end of the plate 14 together pass through the liner 20. The toe 15 is recessed, as at 22, to receive the liner 20 and lower edge of the plate 14, and the forward wall 23 of said recess is spaced from the lower edge of the plate 14 and is concavely recessed, to receive the upwardly curved front edge 24 of the plate 13, said end of the plate 13 being of hook formation and bearing against the convex or rounded edge 25 of the plate 14, which construction permits of the plate 13 being given a pivotal action on the forward end of the plate 14. The plate 13 has secured to its upper surface and somewhat adjacent to its upper edge a series of segmental racks 26 which extent upwardly through slots 27 formed in the plate 14 and are engaged by a latch plate 28 carried by the plate 14, whereby the plate 13 becomes supported from the plate 14 through the latch plate 28 and racks 26 and is adjustable upwardly and downwardly at its upper end portion. The latch plate 28 is in one continuous strip and engages all the racks 26. It is held by a series of latch screws or bolts 29, which extent through the upper end portions of the slots 27, said slots being elongated for



[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

that purpose. On loosening the latch screws 29, said screws and the latch plate 28 may be slid outwardly in a direction from the racks 26, and when the latch plate is in that position the plate 14 may be adjusted to carry the toe 15 properly against the roller 16, and also when the latch plate is in the free condition mentioned, the plate 13 may be lifted upwardly in respect to adjusting it and thereby the passage through the carrier or chute 12. After the plate 14 has received any necessary adjustment and the plate 13 has received such adjustment as it may require owing to the wear on the toe 15, the latch plate is slid back into the racks 26 and the screws 29 are tightened to hold the rack stationary, and thereby hold the plates 13, 14 stationary in their adjusted relation to each other and in the adjustment of the plate 13 to control the vertical diam. of the end portion of the carrier or chute 12. The bottom feed plate 16 may be stationary, if desired, because of the capacity of adjustment of the top feed plate 13 to secure a greater vertical width between its upper end and the upper end of the plate 16 than there may be between the toes 15, 18 where they engage the rollers 10,11. As the toes 15, 18, wear down, the distance between them increases, and then the plate 13 must be adjusted upwardly to compensate for the increased distance which, in use, takes place between the toes 15, 18. The racks 26 and latch plate 28 permit the downward movement of the upper end of the plate 14 to carry the toe 15, as worn, against the roller 10, and the same latch plate and racks permit the upper end of the plate 13 to be adjusted upwardly with each upward adjustment of the toe 15 so as to maintain the proper inclination of said plate 13 with relation to the varying distances between the toes 15, 18. Preferably the bottom feed plate 16 will be rendered adjustable by means similar to those described with respect to the top plate 13, the plate 16 carrying a series of racks 30 extending downwardly through slots 31 in the scraper plate 17 and engaged by a latch plate 32 adjustably secured to the plate 17 by latch screws or bolts 33, these features 30, 31, and 33 corresponding exactly with the features 26, 27, 28 and 29. The plate 17 is supported by a beam 36 which is rockable to permit the toe 18 to be adjusted with relation to the roller 11. The toe 18 is secured to the plate 17 by a series of bolts 27, and said toe is recessed, as at 38, to receive the lower edge portion of the plate 17 and the steel liner 39. The forward end of the recess 38 is concavely machined, as at 40, to receive the hook-like edge 41 of the plate 15, said edge 41 being hooked upon the adjacent convex edge 42 of the plate 17 and all of these features just referred to duplicating corresponding features hereinbefore described with respect to the plates 13, 14 and toe 15 at the upper side of the end of the carrier or chute. The racks 39 and latch plate 32 permit the plate 17 to be adjusted to keep the toe 18, as the same becomes worn, against the roller 11, and as the spacing between the toes 15, 18 becomes increased, due to the wear and adjustment of said toes toward the rollers 10, 11, the plate 16 at its upper portion may be adjusted downwardly so as to aid in maintaining a greater distance between the upper portions of the plates 13, 16 than the distance between the toes 15, 18. The racks 26 may be secured to the plate 13 and the racks 30 to the plate 16 by electric welding or otherwise, as may be found convenient. The racks 26 are equipped with cross pins 43 to prevent their escape downwardly through the slots 27 of the scraper plate 14, and the racks 30 are equipped with cross-pins 44 to prevent their escape through the slots 31 of the scraper plate 17.

ON DESACCHARIFICATION, USING BARIUM COMPOUNDS. **Henry W. Dahlberg**, of Denver, Colo., U.S.A. 1,688,071. October 16th, 1928. Claim is made for the cyclic process of manufacturing sugar and using barium as an extractive agent, which process consists in converting barytic materials which are insoluble in water into water soluble barytic materials by heating insoluble barytic material with alumina and thereby producing a barium aluminate compound containing water soluble barytic material, utilizing the water soluble content of said barium aluminate compound to treat molasses and thereby producing a barium saccharate, separating the barytic content from the sugar content as a water insoluble material, and re-using said water insoluble material in producing a water soluble barium aluminate compound.—CLARIFICATION OF CANE MOLASSES. **Fred Ransohoff** (assignor to the **Fleischmann Co.**, of New York). 1,688,831. October 23rd, 1928. A method of treating cane molasses for use in the manufacture of yeast by an aeration process comprises

treating the molasses with sufficient ammonia to render it alkaline, adding an ammonium phosphate and thereafter separating the solution from substances undissolved therein.—PREPARATION AND UTILIZATION OF INVERTASE EXTRACT. **Leonard Wickenden** (assignor to **John J. Naugle,** of Brooklyn, N.Y., U.S.A.). 1,689,607. October 30th, 1928. Claims are made for : (1) The method of preparing an invertase-containing preparation, which comprises heating yeast in the presence of a sugar. (15) The method of preparing an invertase-containing preparation, which comprises heating yeast in the presence of a sugar syrup, having a pH of from about 4 to about 5, at a temperature of from about 55 to about 65°C. (47) An invertase-containing preparation comprising an invert sugar medium containing therein invertase and being substantially free from alcoholic fermentation bodies, said preparation being sensibly acid.—ACTIVE CARBO-MINERAL PRODUCT (DECOLORIZING CARBON). **Edouard Urbain** (assignor to the **Urbain Corporation,** of Delaware, U.S.A.). 1,689,647. October 30th, 1928. A method of making an absorptive material comprises mixing together carbonizable vegetable material, mineral material comprising a sufficient quantity of tri-calcium phosphate to constitute at least 25 per cent. of the weight of the finished product and phosphoric acid, agglomerating the mass, drying and calcining at a sufficient temperature to eliminate the major portion of the phosphorus, other than such phosphorus as is combined in a tri-basic phosphate.—SPECIFIC GRAVITY REGISTER. **Walter J. Albersheim,** of New York, U.S.A. (*A*) 1,689,658 ; (*B*) 1,689,659. October 30th, 1928. (*A*) A specific gravity register, comprises a casing having provision for flow of liquid therethrough and for retaining a portion of the liquid during its flow, a counter-balanced rotatively supported displacing body in the casing whose specific gravity is approximately similar to the specific gravity of the liquid when of a standard density, said body being submerged in the liquid for being moved by the buoyant effort of the retained liquid when of a density varying from its known standard, means operative by the body when moved to indicate the relative difference of density of the liquid and means for closing the inlet of the casing and to remove the body from its support and for yieldingly holding the body in its separated position. (*B*) A specific gravity indicator, comprises a casing having an inlet and an outlet relatively arranged for flow of liquid therethrough and for retaining a portion of the liquid during its flow, a slidable rotatively supported counterbalanced air chamber in the casing of a weight whose specific gravity is about equal to the specific gravity of the liquid when of a standard density, said air chamber being submerged in the retained liquid for being rotatively moved by the buoyant effort of the liquid when of a density varying from its known standard, means operative with the rotary movement of the air chamber to indicate the relative difference of density of the liquid and means associated with the air chamber for being made effective by the influence of change of the standard temperature of the liquid to slidably adjust the air chamber for keeping the indicating means in its normal position at all temperatures of the liquid.—MAKING SYRUPS. **Frank B. Lomax,** of Chicago, Ill., U.S.A. 1,681,490. August 21st, 1928. Claim is made for the method of forming a filtered solution which consists in enclosing spaces above and below a filtering barrier filling each space with a liquid, placing a solute in the liquid above the filtering barrier, agitating said liquid and solute above the barrier to cause the solute to be dissolved in said liquid, mixing the liquid below the barrier with solution above the carrier and circulating the resultant solution through the barrier to filter the same.—FIBRES FROM SUGAR CANE. **Joaquin J. de la Rosa, Sr.** (assignor to **Bagasse Products Corporation,** of New York). 1,681,223. August 21st, 1928. A method of producing textile fibres from sugar cane includes the steps of permitting the cane to ferment so as to initiate the generation of acids and then wetting the fibrous part of the cane with running water.—GLUCOSE AND CORN SUGAR. **Charles R. Brown and Hubert E. Nelson,** Keokuk, Iowa, U.S.A. 1,690,359. November 6th, 1928. In a process of manufacturing glucose and corn sugar from corn grits that have been prepared by cracking, degerminating and dehulling of corn kernels, that step which comprises treating said corn grits with a dilute mineral acid of a concentration just sufficient to solubilize basic salts contained in said corn grits and washing said grits prior to further treatment.

UNITED KINGDOM.

REMOVAL OF ALBUMINOUS SUBSTANCES FROM JUICES, SYRUPS, AND MOLASSES. **Jacob Pohlmann and Jacobus R. F. Rassers**, both of Leiden, Holland. 287,119. March 15th, 1928; convention date, March 15th, 1927.

These inventors explain that the "ferment-albumina" which constitute the dead chemical substrates of the previously active ferments, are precipitated but remain in solution during the treatment, resisting all operations in the manufacture so that they may again be found dissolved in the molasses. These albuminous substances constitute protective colloids which impede crystallization. That this simple solution of the problem has escaped the attention of so many investigators, who endeavoured to overcome the inefficient crystallization of molasses by chemical means, is due to their ignorance of the properties of the said ferment-albumina, which is here called "small albumina," as from the data known from the physiological chemistry it is clear that with the usual operations in the sugar industry it is not possible to precipitate these ferment-albumina in contradistinction to the "large albumina" which are removed from the material by the diffusion and subsequent treatment with lime. However, the ferment-albumina generally is precipitated by addition of tannin, picric acid, etc., in a weak acid medium. These chemicals have been previously applied in the sugar industry. NOEL DEERR[1] mentions tannin as additional substance for the purification of cane juices, however, not without application of lime, as is also the case with the processes according to the British patents of earlier date mentioned by him. The use of tannin in connexion with alkaline juices has also been proposed. However, according to applicants' experience it is quite wrong to use tannin in connexion with alkaline juices, as in an alkaline medium the ferment-albumina are not precipitated. This most certainly appears from the fact that a precipitate of the said ferment-albumina, formed according to the process of our invention, in a weak acid medium is entirely dissolved by the addition of $Ca(OH)_2$ to an alkalinity of 2/100 N. According to the invention therefore it is necessary to operate with acid or neutral juices, operated at normal temperature, so that the danger of inversion is reduced to a minimum. Removal of the ferment-albumina produces the following advantageous results: Crystallization is promoted, resulting in a higher yield of sugar and a reduction of the quantity of molasses which may be given a second crystallization or used as treacle for consumption, as its bad taste is removed. Example of carrying the process into effect:—100 grm. of cane or beet molasses are diluted with three times the quantity of water and 1 ccm. of phosphoric acid is added for acidification. Subsequently 1·75 grm. of tannin dissolved in a small quantity of water is added, whereupon a voluminous precipitate is formed and separated from the liquid by filtration. In order to ascertain that a sufficient quantitiy of tannin has been added, the filtrate is tested with a solution of ferric chloride. For removing the excess of tannin from the filtrate, slaked lime is added, resulting in the formation of a precipitate of calcium tannate, which is again separated by filtration. All these operations are performed at normal temperature. To remove the excess of the added lime, carbonic acid is passed through the liquid which preferably may be slightly heated to about 50°C. The precipitate thus formed is removed by filtration and the filtrate may be concentrated by evaporation until it has obtained the consistency of syrup. The treatment with lime gives the advantage that in addition to the removal of the excess of tannic acid, also tannin-iron compounds, which may be formed, are removed.

PRODUCTION OF DEXTROSE. **E. C. R. Marks** (communicated by **Corn Products Refining Co.**, of New York). 300,698. August 19th, 1927.

In the preparation of dextrose from starch, particularly maize starch, the converted starch solution is concentrated to a crystallizing supersaturated condition and maintained in this condition by the continued extraction of water, the liquid being agitated until the desired point of crystallization has been reached. A solution containing 94 per cent. or more of dextrose is concentrated in a vacuum pan to a density of from 40 to 49°Bé., at a temperature of from 45 to 60°C. For the pro-

[1] "Cane Sugar," 1921, p. 294.

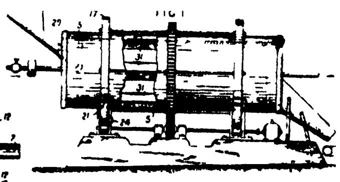
duction of β anhydrous, the temperature should be at the upper end of this range, preferably 58°C., for a hydrate at the lower end, preferably 45°C., and for a anhydrous at an intermediate point, 50°C., although as high a temperature as 55°C. may be used. The liquor is then seeded with dry crystals, or with a mixture of mother liquid and crystals, of the desired kind. For a anhydrous, with a purity of 94 per cent. in the original solution, a temperature of 55°C. and a density of 45°Bé., half one per cent. of seed crystals may be employed. With an initial purity of 97 per cent. or more the seed employed need only be a trace or none at all, and the temperature may vary from 50 to 45°C. with a reduced density of 43°Bé. Should the viscosity be too great by reason of impurities, the amount of seed crystals should be increased or a greater agitation produced by the use of stirrers, etc. When the desired quantity of crystals has been induced, further formation of crystals is prevented by the introduction of fresh liquor and the boiling is continued only rapidly enough to ensure circulation and the growth of the crystals present to the desired size. As the solid phase increases the boiling may be more rapid, the concentration of the mother-liquor and the maintenance of temperatures favourable to the formation of a anhydrous may be disregarded, and the vacuum may be increased; liquors of lower purity may also be introduced. At the end of the operation, the liquor is discharged from the vacuum pan and centrifuged to extract the crystals. Should the rate of crystallization be slow or the viscosity of the liquid be high, the massecuite may be treated in known manner, involving the lowering of the temperature, in a crystallizer. (Specifications 227,140, 232,160, 232,938, 246,098 and 254,729 are referred to).

PRODUCTION AND REVIVIFICATION OF DECOLORIZING CARBON. **Leonard Wickenden,** of Flushing, New York, and **Stanley A. W. Okell,** of Tyrone, Penn., U.S.A. 300,146. July 5th, 1927. See U.S. Patent, 1,634,480.[1]

COOLING SUGAR (PARTICULARLY ICING SUGAR). **A. E. White** (communicated by **Ackers Lonsdale & Co. Prop'y Ltd.** and **George Lonsdale,** of Sydney). 298,735. August 18th, 1927. An apparatus is described for cooling fine sugars, in order thus to avoid their lumping when bagged. It comprises an inclined rotating cylinder surrounded by a water jacket extending the full length of the cylinder and rotating therewith means for supplying water continuously to said jacket, and rotatable connexion between said means and jacket. As shown in Fig. 1, a tooth-geared water-jacketed drum 5 revolves on runners 17, 21 and thrust rollers 24 are provided at the feed end 29. The water connexion, Fig. 3, comprises a stationary pipe service 7a having a flange 14 engaging the rotary flange and pipe 13, 7, the joint being completed by a disc 14 and packing pieces 12. Agitator blades 31 are provided on the inner periphery of the drum.

FIG. 3

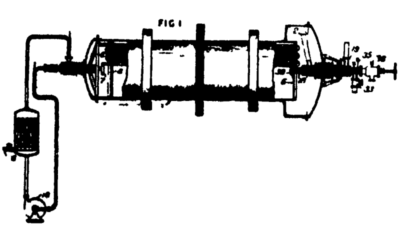
FIG. 1



—CONDENSATE REMOVING SYSTEMS. **R. Bell-Irving and P. Sandwell,** of Powell River, British Columbia, Canada. 301,213. December 9th, 1927. The main condensate outlet of a steam chamber is continuously sealed by the condensate and is normally closed, there being means for opening the main outlet in response to an initial discharge of condensate through an auxiliary outlet.—BOILING SYRUPS. **F. Lafeuille,** of 35, Rue Brunel, Paris. 301,304. October 4th, 1928; convention date, November 26th, 1927. Syrups are boiled in sugar factories by drawing the whole quantity of syrup from which a strike is to be made into a cylindrical, cylindro-conical or prismatic boiling and crystallizing rotating apparatus provided with a jacket or a system of tubes for circulating heating or cooling means, vacuum and syrup intakes and an emptying door. The syrup is concentrated to a suitable degree Brix and caused to grain by applying a higher vacuum, e.g., by shutting off the steam or circulating water. The building up of the crystals as well as the exhaustion of the mother-liquor are attained by gradual concentration accompanied with stirring of the total quantity of syrup and finally cooling down

[1] *I.S.J.*, 1928, 51-52.

in said rotating apparatus. The finished massecuite prior to the final cooling may have added to it green molasses of a first strike, then boiled further and cooled down. IMPROVEMENTS IN MAKING PULP PREPARATIONS FROM GRASSES, ETC. **O. Y. Imray (I. G. Farbenindustrie A.-G.** of Frankfort-on-Main, Germany). 298,333. In the manufacture from wood, straw, grasses, or the like of cellulose free from lignin, the material is treated at a temperature not exceeding 45°C. with such a quantity of an alkaline earth hypochlorite solution as is just sufficient for complete oxidation of the lignin, the solution used originally containing at least 2 per cent. of available chlorine, and being always maintained feebly alkaline with an alkaline earth such as calcium hydroxide.—DENATURING ALCOHOL. **I. G. Farbenindustrie A.-G.**, of Frankfort-on-Main, Germany. (*A*) 298,611. (*B*) 298,617. October 12th, 1928; convention date, October 12th, 1927. (*A*) Alcohol is denatured by those fractions of coal-tar pyridines which boil above 120°C. and are only sparingly soluble in water, or by such sparingly-soluble homologues of synthetic pyridines obtained, e.g. from croton aldehyde or acetylene or paraldehyde and ammonia. These denaturants may be used alone or mixed, and with or without the usual water-soluble pyridines. In an example 1000 c.c. of alcohol are denatured with 5 c.c. of a 50-50 mixture of the pyridines boiling above 120°C. obtained according to Specifications 146,869 and 283,163. (*B*) Alcohol is denatured by one or more neutral substances which render the alcohol distinctive in taste and odour even after fractionation over acid or alkali, or filtration through charcoal, or shaking with paraffin oil. Denaturants specified are methyl sulphocyanide, allyl alcohol, allyl carbinol, diethyl sulphide, dimethyl sulphide, methyl-ethyl-sulphide, diacetyl sulphide, aceto-nitrile, thioacetic ester, thiobutyric ester, ichthyol oil, and products containing such or similar substances.—MANURES. **Stockholms Superfosfat Fabriks Akt.**, of Stockholm, Sweden. 301,387. November 23rd, 1928; convention date, November 28th, 1927. A mixed fertilizer is prepared by subjecting a mixture of a potassium salt, phosphoric acid, and a second acid, for example, nitric acid or sulphuric acid, in thin layers to the action of gaseous ammonia. The treatment may take place in worm-conveyor apparatus through which the ammonia and the mixture are passed in counter-current. The product may be dried in a second worm-conveyor apparatus.—ROTARY CRYSTALLIZER OR CRYSTALLIZER-BOILER. **F. Lafeuille**, of 35, Rue Brunel, Paris. 301,453. October 4th, 1928; November 30th, 1927. A tubular rotary crystallizer or crystallizer boiler comprises a cylindrical casing 1 within which a substantially jointless heating system is provided consisting of pipes arranged in groups between stay plates 4, 5, the apertures of the inlet tubes being led to a crown 6 and the outlets to a crown 7. The convolutions of the pipes are arranged in spiral or other curves and the joints with the elbow pieces at the ends are made by welding. Hot water is circulated through these pipes by a pump 14, steam being led into the heating-system through a pipe 16. Massecuite enters through a stationary pipe 18 in which a screw 38 connected with the rotating casing 1 is situated, the passage of the massecuite into the casing being assisted by a vacuum maintained in a chamber 2, the vacuum intake being through a pipe 19. Syrup may be introduced through a valve 33, valves 35, 36 serving to clean the pipes by means of a steam jet. Specifications 245,114 and 234,345 are referred to.—PURIFICATION OF MOLASSES, ETC. **T. Gaspar y Arnal**, of Madrid. 297,482. May 23rd, 1927. Sugar solutions, such as molasses, are treated with sufficient quantities of soluble ferrocyanides to precipitate alkali or alkaline earth salts including magnesium in the form of double ferrocyanides of calcium and potassium. Thus, if it is desired to remove potassium chloride, calcium ferrocyanide or a mixture of sodium ferrocyanide and calcium chloride may be added. To remove calcium chloride, sodium ferrocyanide and potassium chloride may be added. The precipitation may be effected in the presence of an alcohol or similar organic liquid. The double ferrocyanide obtained is treated with an iron or copper salt and a little acid to produce Prussian blue and calcium and potassium salts.



United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to Jan. 26th	44,155	..	45,005
Deliveries „ „	130,944	..	196,728
Meltings by Refiners „ „	161,379	..	183,800
Exports of Refined „ „	2,000	..	3,000
Importers' Stocks, Jan. 26th	85,803	..	97,426
Total Stocks, Jan. 26th	120,092	..	170,300
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT DECEMBER 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928· Tons
Exports	4,099,127	..	3,728,618
Stocks	212,314	..	124,403
	4,311,441	..	3,853,021
Local Consumption	146,000	..	68,857
Receipts at Ports to December 31st	4,457,441	..	3,921,878

Habana, December 31*st*, 1928. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(Willett & Gray's Estimates to January 31*st*, 1929.)

	1928-29. Tons.		1927-28. Tons.		1926-27. Tons.
CANE.					
America	8,922,900	....	8,162,400	....	8,610,169
Asia	7,226,164	....	6,895,686	....	6,322,240
Australasia	638,000	....	588,163	....	484,682
Africa	694,695	....	651,330	....	600,997
Europe	——	....	9,000	....	6,719
Total Cane	17,481,759	....	16,306,579	....	16,024,807
BEET.					
Europe	8,225,000	....	8,031,874	....	6,871,892
U.S.A	925,000	....	965,241	....	801,246
Canada..............	33,000	....	27,212	....	31,422
Total Beet	9,183,000	....	9,024,327	....	7,704,560
TOTAL CANE AND BEET....	26,664,759		25,330,906		23,729,367

United Kingdom Monthly Sugar Report.

Our last report was dated January 10th.

The general condition of the market is unchanged, although a sagging tendency has prevailed, and prices both for Raw and Refined are easier.

The White Terminal Market has been very restricted and transactions few. Dealings are becoming more and more difficult, but on balance a decline of 6d. per cwt. has been registered during the past month. March is still rather tightly held and sold from 12s. 5½d. to 11s. 11¼d. May fell from 12s. 5½d. to 11s. 7½d., and August from 12s. 7½d. to 11s. 10½d.

The Raw Terminal Market has shown heavier registrations and orders are being placed with much greater ease than formerly. March sold from 9s. 1½d. to 8s. 9d. May from 9s. 2½d. to 8s. 10½d., and August from 9s. 6d. to 9s. 3d., whilst December fell from 9s. 9d. to 9s. 4½d. The latest prices are :—

	March.	May.	August.	December.
White	11s. 11¼d. ..	11s. 7½d. ..	11s. 10½d. ..	12s. 1½d.
Raw	8s. 9d. ..	8s. 11¼d. ..	9s. 3d. ..	9s. 4½d.

Dealings in actual sugar have been very slow and in the main confined to Home Grown and British Refined. Since the last Budget all the refiners have increased their melt, and for the last six months there has been over-production of White sugar in this country, consequently stocks of White sugar have accumulated, and the price has fallen by 1s. per cwt. The refiners reduced their price 6d. on January 16th, 3d. on January 28th and 3d. on February 1st. Their latest prices have been No. 1 Cubes 25s. 9d., London Granulated 22s. 10½d. The prices for Home Grown have been reduced to 22s. to 22s. 9d. according to factory.

Continental Granulated has fallen from 12s. to 11s. 9d., and Czecho Granulated for re-opening has been offered down to 11s. 4½d. : May/August 11s. 6d. and November/December at 11s. 7½d.

Raws have been easier, and although Cubans have not been sold below 9s. 6d., Perus afloat have been sold as low as 9s. 3d. c.i.f.

The American market has been easier and Raws have fallen to 2 cents and at one moment a 32nd lower was accepted. The futures market has also fallen six or seven points.

With regard to Europe, F. O. Licht again increased his estimate of the European crop to 8,337,000 tons against 8,040,000 tons last year.

21, Mincing Lane,
London, E.C.3.,
8th February, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 363. MARCH, 1929. Vol. XXXI.

Notes and Comments.

The Outlook.

The long hoped for advent of better sugar prices still tarries, in spite of the efforts of various sugar economists and statisticians to prove that there is no over-production. We are told that one factor that militates against an immediate improvement in prices is the absence from the sugar market of the outside speculator prepared to consider and anticipate distant possibilities. There was a time when this individual was much in evidence in sugar market operations, but latterly he has deserted the market for other fields of speculation that seem more remunerative. Be this as it may, it does not explain why buying movements seem almost invariably weaker than selling movements to-day, save on that theory of over-production which some students of the situation refuse to admit exists. Elsewhere we give a summary of an analysis prepared by Dr. Geerligs for the League of Nations Economic Committee, in which he concludes by saying that if production is not allowed to increase suddenly in the future but to develop gradually, consumption will probably absorb it. But if production is allowed to go ahead at the rate of recent years, it may be a long while ere equilibrium is restored. What seems fully admissible from this is that production has already secured a considerable start in the race, and that it is this advantage coupled to the uncertainties of the immediate future which helps to keep the markets depressed. One such uncertainty relates to probable early changes in the U.S. tariff, which may be the subject of a special session of Congress, and may come into force any time between May and November. It is a good thing that the League of Nations are going into the sugar question in earnest, in the hope of finding a way of stabilizing the production side of the industry. They are organizing consultations amongst expert representatives of the sugar industry from fifteen producing countries, including Britain, India and Japan. It is too early to say whether consultation will be followed by achievement, but a round-table conference under the auspices of the League should offer more chance of success than private endeavours on the part of one or two interested sugar producing countries.

United Kingdom Consumption, 1929.

According to the official figures supplied by the Board of Trade, the consumption in the United Kingdom during 1928 of Raw, Foreign Refined, and United Kingdom Refined[1] came to 1,795,708 tons, or, in raw sugar value, to 1,851,313 tons, which compares (also in raw value) with 1,681,351 tons in 1927, 1,776,766 tons in 1926, 1,817,869 tons in 1925, and 1,893,429 tons in 1913. But these amounts as explained in former years do not include the supply of Home Grown sugars. These amounted in 1928 to 186,175 tons in terms of white sugar or to 204,792 tons expressed in raw value; this compares with 169,887 tons (186,875 tons) in 1927 and 117,562 tons (129,318 tons) in 1926. Adding together imported and home produced sugar *in raw values*, we arrive at a total figure for Home Consumption within the United Kingdom of 2,056,105 tons in 1928, as compared with 1,868,226 tons in 1927, 1,906,080 tons in 1926, and 1,854,594 tons in 1925. On the basis of the present estimated population of 46½ millions, the 1928 figures work out at 99·05 lbs. raw value per head, but at 95·46 lbs. on actual quantities.

As pointed out in our *Notes and Comments* last month, these figures are by no means meticulously accurate; indeed they tend to be somewhat misleading, inasmuch as in regard to imported raws, the official figures issued represent duty-paid sugar brought into the refineries and officially classed as "consumption," but they are no real criterion of the actual deliveries to distributors. Nevertheless in the long run, if the present system persists, the annual return may be considered as near the mark as it is possible to expect.

West Indian Views on Empire Preference.

At the Triennial Conference held in Barbados at the end of January, the question of the duty on Empire sugar came up for discussion, and a resolution was carried urging the British Government to take immediate steps to increase the preference. One Barbados speaker explained that it was desired to raise the preference on 96 raws from 3s. 9d. to 4s. 4d. per cwt., and so bring it more into line with the Canadian allowance.[2] The present preference on Empire sugar on entering into England worked out at 80·3 cents per 100 lb. If the increase asked for were granted the preference would work out at $1·17 per 100 lb. The Canadian preference on 96 degrees sugar was $1·00 per 100 lb. In spite of this increased preference the manufacturers of sugar in these colonies would not be able to make ends meet, and he felt it his duty to place it on record that this increase would not cover the loss which was at present existing on production cost. The cost of producing sugar in Barbados in an average crop was about £13 per ton, excluding items such as renewal of machinery, maintenance of cultivation, extension of cultivation, and interest on capital. This production cost of £13 per ton worked out at $2·79 per 100 lb. The value of sugar at present was about $2·45 per 100 lb.; so that the planter was faced with a loss of 34 cents on purely production cost. This price of $2·45 included 85 cents of Canadian preference, and with the additional amount of Canadian preference which they were hoping to receive the price of sugar would be advanced to $2·50, which still resulted in a loss of 19 cents on production cost alone. If England increased her preference, as had been asked for in the resolution, the additional amount would be 16 cents per 100 lb.[3]

1 This item comprised the sugar refined in Bond, prior to the Budget of 1928 which abolished the distinction between Home Refined and Imported Raws.

2 For what follows we are indebted to an excellent account in the *Financial News*.

3 There is a belief extant that in the coming Budget a further preference of 1s. will be given.—ED.

As for the suggestion that they should overcome this difficulty of cost of production by organizing large sugar factories, the same speaker asked where the capital for their establishment was to come from. He claimed that they were doing all that was possible, by keeping their machinery up-to-date, improving the tillage of the soil, and applying scientific research, including soil chemistry, cane genetics, and control of insect pests. But immediate results could not be looked for, and it was the present crisis of low prices that was too much for them. A Jamaica speaker who seconded the resolution denied that they were trying to put on the world market a commodity produced on an unsound and uneconomic basis ; they were up against a set of artificial conditions in that market, including the circumstance that some British countries were producing sugar for local consumption on terms that allowed them to sell the surplus abroad at excessive low rates.

The Needs of Mauritius.

A letter which appeared in a Mauritius newspaper shortly before Christmas over the nom-de-plume of "Un Vieux Colon" (which is generally ascribed to Sir Henri Leclezio), deals with the situation in which the Mauritius sugar producers found themselves immediately after the last British Budget gave a fillip to imports of raw sugars into this country and a comparative setback to those of white sugars. The change, we are told, caught the Mauritius sugar industry unprepared. They were unable at the outset of a new crop to alter their mode of production and turn out raws ; but the effect of the fiscal change was to favour raws on the British market, as a result of which the Mauritius sugars sold badly, and the majority of the estates suffered in consequence a more or less heavy deficit.

Now Mauritius is one of our best Crown Colonies, and at several periods in the past we have come to her aid to tide her over difficulties, e.g., after a disastrous cyclone in 1892, and at the beginning of the present century when disease wiped out nearly all draught animals. The island has but one staple industry, that of sugar production, which is the mainstay of its 400,000 inhabitants, and none of the subsidiary industries has any chance of replacing it or of coming to the aid of the colonists when the sugar industry fails. The latter has its periodical crises, but sugar invariably rights itself if given a chance. Of late, however, it has suffered from the evil of prolonged low prices and, as above-mentioned, the last straw has been a bad market for its 1928 crop, and a severe drought since last August which has reduced the supply of sets to plant for 1929. The result is that the industry is short of the usual means wherewith to carry on, and a loan has had to be negotiated. The view of the industry, as voiced by this Mauritius writer, is that a long term loan at a low rate of interest is fully justified, and could be guaranteed by the proceeds of the coming crop. In addition a further big loan at a low rate of interest to pay off all mortgages is sorely needed. Rumour has it indeed that the Home Government will consent to a loan of 25 rupees a ton on the crop. If this proves to be the case, then something under half-a-million sterling will have to be advanced to Mauritius to help her to tide over the stringency with which she is at present faced. If nothing more, this contretemps offers ample evidence of the uneconomic position of world sugar prices, and justifies the efforts of those who would call a halt, by some means or other, to the excessive over-production, not only of free exporters like Cuba and Java, but also of State-aided industries which are being encouraged to increase their export quota in advance of the world demand.

A Co-operative Refinery for Mauritius mooted.

A somewhat different problem for Mauritius sugar planters is the question whether they should embark on a scheme to refine their own sugar instead of offering it to independent refineries. A factory manager in Mauritius, Mr. F. N. COOMBES, contributes some interesting views to the Mauritius journal *Le Cerneen*, of which the following is the gist. The ascendancy of the refining interests in England which will probably continue so long as the Conservatives are in power is a factor to be reckoned with. Save for the small proportion of " Extra fine " white sugar which Mauritius turns out, the bulk of her whites do not meet the needs of the English market sufficiently to ensure any advantageous sale. Nor can they compete with Java whites, inasmuch as Java can turn out 7 tons of sugar to the acre as compared with Mauritius's 2¼ to 2½ tons. For these reasons Mr. COOMBES frankly advocates a return to making raws only, and suggests at the same time that Mauritians should consider the feasibility of having their own bonechar refinery. This, he argues, should be located in the United Kingdom and not in Mauritius. The reasons against the latter course are that if the refinery worked 250,000 tons a year, 80,000 would be refined during the crop season, while the balance of 160,000 tons of raw sugar would have to be stored for the rest of the year's refining operations, which period would include the wet season when the raw sugars would not keep well and the danger of damage from cyclones would be greatest. Then the refinery fuel (coal) would all have to be imported at considerable expense ; and, finally, the refinery would be far distant from the ultimate market of its output, hence from those who wanted to inspect samples.

For these reasons Mr. COOMBES advocates that Mauritius should follow the example of other big world centres of raw sugar production (such as Cuba, Hawaii, and even Java as regards her raws) and put the refinery near the point of the ultimate market. He therefore suggests Mauritius should create in England a co-operative refinery belonging to a syndicate of Mauritius planters, to be capable of refining at least 250,000 tons of sugar per annum. To this refinery should go the production of the island in the form of raws, and the producers could then look forward to a steady market for their sugars, instead, as at present, of having to offer their sugar to an unwilling market at a proportionate reduction in price.

Tobacco versus Sweets.

A new and most objectionable form of advertising of cigarettes was started in the United States a few months ago and has caused a *furor* in sugar-using trade circles in that country. It would appear that the tobacco manufacturers came to the conclusion that the market for smoking amongst men was saturated, so they conceived the idea of making a widespread appeal to women to take up the smoking habit. The method adopted was the subtle one of suggesting that sweets were not good for the figure or indeed for the health generally, and that the adoption of a cigarette habit would reduce the taste for confectionery and sweets, and so eliminate what was alleged to be a harmful habit. An advertising propaganda on these lines was accordingly started in the American press ; in addition, thanks to the custom in the States which allows the wireless broadcasting of advertisements, the same theme has been spread to listeners-in from nearly 40 broadcasting stations. The dire effect on the market for sugared goods in consequence of this propaganda can easily be imagined.

As a question of ethics, this new idea of bolstering up in an advertisement the merits of one product by attacking directly or by strong inference the merits of an entirely different product seems utterly reprehensible. If such advertising were permitted one might find the purveyors of alcoholic drinks deprecating the consumption of tea or coffee; the sellers of butter, for instance, decrying the use of margarine. The result would inevitably be a rush of retaliatory advertising which would lower the tone and the value of all advertising generally; in the end this universal form of communication between producer and consumer would fall under a perpetual cloud of suspicion, in which both sides would suffer.

The immediate result of this tobacco propaganda in the United States has indeed been that the sugar using industries there have been forced to adopt a counteracting advertising campaign. This, rightly we think, has not taken the retaliatory form of decrying tobacco, but has mainly concentrated on stating the case for the use of sugar and sweet foods in the diet. Under the lead of the Sugar Institute, an educational campaign has been inaugurated in the press of the States on these lines, which cannot fail to do much good, and will probably be the forerunner of a sustained habit of advertising the merits of sugar as a food—a habit which in the past has been on too meagre a scale where it existed. and too frequently has not existed at all.

It may be added that this American advertising innovation crossed the Atlantic, and an attempt was made in the United Kingdom to start a similar campaign of advocating tobacco consumption in preference to that of sugared goods. But whereas in America the cigarette manufacturers could only be appealed to to stop this objectionable form of advertising, over here there is better control of the press through its various Associations, and the latter were quick to perceive the objections to any advertising of this type. As a consequence, the campaign was effectively countered, before it had time to set a fashion. But the lesson may not be lost if the attention given to it by the sugar-using trades leads to the reflection that the best defence against any decrying of sugar as a food, whether openly or inferentially, is the education of the public by means of suitable advertising of the merits of the product.

Indian Crop Figures.

The final general memorandum of the Indian sugar cane crop of 1928-29 as published officially in India, which deals with 95 per cent. of the total area under cane, states that the area sown is estimated at 2,576,000 acres, as against 2,952,000 last year—a decrease of 13 per cent. The total yield of raw sugar (gur) is estimated at 2,735,000 tons, as compared with 3,216,000 tons last year—a decrease of 15 per cent. The condition of the crop is, on the whole, reported to be fair.

According to figures supplied by the Sugar Bureau at Pusa, the production of sugar direct from cane by factories in India during the 1927-28 season amounted to 67,684 tons, which compares with 62,941 tons in the previous year. The recovery per cent. averaged 8·62 as compared with 8·49 in 1926-27. The highest recovery was shown by a factory working tropical canes, its average for the whole season being 11·1 per cent. In Northern India, where thin or medium thick canes are crushed, one factory working with the carbonatation process averaged 9·8 per cent., while the highest recovery shown by a sulphitation factory was 9·4. Two new sugar concerns at Basti and Lachmiganij in the United Provinces are under construction and will probably work in the present season. The imports of sugar into India in 1927-28

amounted to 725,800 tons, as against 826,900 tons in 1926-27 ; this decrease was due to the fact that at the beginning of the year stocks of sugar in India were ample to meet the demand, and the fall in price as the result of increased supplies made buyers adopt a hand-to-mouth policy. Indian sugar interests are watching with considerable apprehension the remarkable achievements of the POJ 2878 cane in Java. At the very low figure at which Java is now able to turn out plantation white sugar it seems almost certain that she will endeavour to swamp the Indian market, since there is no other visible outlet for her production. Against such inroads, the Indian industry seems helpless unless it is accorded suitable protection.

Another Engineering Amalgamation

It falls to us to announce another amalgamation of two firms interested in the cane sugar industry, viz.:—Messrs. H. W. Aitken Co., Ltd., of Glasgow, and Messrs. A. F. Craig & Co., Ltd., of Paisley. For many years Messrs. Craig have been the principal manufacturers of " Aitken " sugar machinery. In the strenuous times, however, through which we are passing, and apparently have still to pass, a fusion of interests that will eliminate everything in the shape of duplication of expenses has been deemed advisable, so that the machinery produced by these firms will be manufactured under the conditions most favourable to successful competition with that made in Europe and America.

The name of " Aitken " has long been associated with the manufacture of cane sugar machinery in the Glasgow district. The present Mr. AITKEN'S father (Mr. T. M. AITKEN) began his sugar machinery career with the firm of P. &. W. McOnie (now the Mirrlees Watson Co.) in the year 1844 ; at a later date he joined the firm of W. &. A. McOnie (now the Harvey Engineering Co.), in which concern he was successively Chief Designer, Manager, and Managing Partner In 1881 Mr. T. M. AITKEN founded the firm of Aitken, McNeil & Co., Govan, which his son, Mr. H. W. AITKEN, joined at that time. Mr. AITKEN senior died in 1890, and the business was carried on by his son and the late Mr. JOHN McNEIL until 1897, when Mr. H. W. AITKEN founded his present firm.

Mr. AITKEN has devoted himself entirely to the construction and improvement of machinery used in the manufacture of cane sugar, and has made long and repeated visits to all the cane sugar producing countries of the world in order to familiarize himself with their different methods of working and their individual requirements. His machinery is well known in all cane sugar countries, and the specialties which he has introduced, such as " Diamond " rollers, " Grano " rollers, " La Corona " and " Diadem " hydraulics, etc., have been largely adopted and are much appreciated in many countries.

Messrs. A. F. Craig & Co., Ltd., were established in 1868, and their works now cover an area of nine acres. Their foundry, in which all Messrs. Aitken's " Grano " rollers have been cast, is one of the largest in the country and is conducted on the most scientific lines by a highly trained metallurgical staff. Their engineering works are specially laid out for the manufacture of sugar machinery, and are among the most modern and best equipped in the United Kingdom. The combination that has now been effected should tend to the production of the highest class of sugar machinery at the lowest manufacturing cost.

The British Sugar Beet Society.

Report for the Year 1928-29.

The Annual Meeting of the British Sugar Beet Society was held on March 7th, Col. E. ROYDS, the new Chairman, presiding. The following is the principal part of the Report which was presented to the gathering.

Acreage under Sugar Beet.—The acreage sown to sugar beet in 1928 was only, in round figures, 178,000 acres, or a falling off of some 47,000 acres. The yield per acre, however, was somewhat larger, although below 8 tons, which is much less than it should be. The average sugar content was 17·3 per cent. or about 1·2 per cent. over that of 1927. It is satisfactory that there is every prospect of a materially increased area being sown to sugar beet this year. In order to help this increase further, the factories have adopted an arrangement whereby contracts may be made with growers to consign to any agreed factory, irrespective of distance, at a fixed charge for carriage, the extra cost being borne by such factory. This shows the desire of the manufacturers to popularize sugar beet growing, and should tend to bring in much wider areas, thus extending the general benefits to agriculture.

In the course of the year price negotiations were carried out between the manufacturers and the growers, and it was stated that fair terms had been agreed to ; but unfortunately these reduced prices coincided with a very bad season, in which growers' expenses were heavy and their yields light, so that although in many instances sugar beet was their only paying crop, many farmers declined to enter into contracts at the agreed price. Fortunately the campaign just concluded shows an improvement in the yield and sugar content of the roots, and reduced costs in most cases, so that on the whole farmers have made fair and often handsome profits. Growers at the same time are being earnestly advised to concentrate upon improving their methods, so as to raise the average tonnage per acre ; it is a standing reproach to any farmer that he can only grow 3 or 4 tons per acre (say one little plant to a square yard) when a neighbour succeeds in growing four or five times that quantity at no greater cost for cultivation. Last year the President, Lord ERNLE, stressed the importance of farmers ascertaining and recording the direct costs of producing and delivering the crop. It is to their interest to be fortified with those figures before the time comes for negotiating new prices with the factories. In most cases growers appear to have entirely lost sight of the very substantial indirect profits which are stated on reliable authority to accrue.

Sugar Output.—In 1927-28, the factories produced 190,250 tons of sugar, a figure much below anticipations. The outcome in the campaign just ended (1928-29), was 194,280 tons, a result which must be considered satisfactory in view of the reduced acreage of roots.

Factories.—Only one factory project, that at Brigg in Lincolnshire, materialized in the year under review. Several circumstances appear to have contributed to this lack of enterprise, such as doubts with regard to the position at the end of the subsidized period, discontent of some farmers with the sub-division of the reduced subsidy, the very low average tonnage produced in comparison with the best yields and with the average in other countries, falling world prices for sugar, and finally a desire to see real results of the Oxford desiccation process. The direct effect of the revised sugar duties in the 1928 Budget was, however, a stimulant to the factories ; it led to cordial relations being established between the refiners and the beet industry, and it gave the beet factories a chance to carry on the business of refining during that portion of the year when they would otherwise have lain idle. As Sir ERNEST

TATE has remarked, this new feature may well be a vital one in estimating the prospects of the beet factories in the future when the present subsidy disappears. Not only will this mean the practically constant employment of a large number of skilled and unskilled labourers, but it will cause increases of production in many directions to supply the requirements of what is to-day a new industry, as a large number of the refineries in this country were put out of business many years ago by the ever-increasing quantities of refined sugar imported from the Continent. It is therefore to be hoped that the adoption of this policy by the factories will add stability to the industry, and, in adding strength to their economic working, place them in a more favourable position for dealing with ever-increasing supplies of beets, to the great advantage of the farming community.

Factory Financial Results.—From the audited accounts of the factories, published under the Subsidy Act, it would appear that all the factories made profits, great or small, and have very properly increased their reserves out of the subsidies received. Meanwhile, the manufacturers have had to face the risk of a falling world market.

Mason Challenge Cup.—The entries for this cup competition suffered a decline, partly owing to other prizes being offered by the factories. The first award went to a grower in Saffron Walden, Essex, for a yield of 18¾ tons per acre with a sugar content of 17·72 per cent., which compares with 16 tons per acre and 18·7 per cent. achieved by the 1927 winner, a Worcester grower.

Oxford Desiccation Process.—Further progress has been made in bringing this process to commercial practicability. The "Sugar Beet & Crop Driers Ltd." company has been formed to further the scheme.

Effluents.—The disposal of waste waters from beet sugar factories has proved to be one of considerable difficulty, not only on account of the constitution of them, but also because of the very large quantities to be dealt with in such a limited time. Investigations are still going on at great expense, much of which is being borne by the companies, and satisfactory solutions will be found. Very great reduction of the water to be dealt with would appear to offer a field for exhaustive exploration. The Oxford process gives much encouragement in this direction. It may be noted in passing that the waste water to be disposed of from a sugar beet factory daily during the campaign is equal to the water supply of a large town. Also that the plant lies idle the greater part of the year, and has to be nursed into working order at the start of each campaign.

Factory Technical Staffs.—The British Association of Chemists communicated with the Society relative to the hours worked and the remuneration of beet sugar factory chemists. This matter received the attention of the respective managements in direct negotiation with the Association. A question was also asked in the House of Commons respecting the nationalities of the technical staffs employed in beet sugar factories, in reply to which the Minister of Agriculture stated that of the higher technical staffs numbering altogether 443, 84 per cent. were British and 10 per cent. American.

Residual Products.—An important discussion was raised in the House of Lords during the year, when Lord STRACHIE asked for a return showing the exports of sugar beet pulp. Several questions were also asked in the House of Commons on the same subject. The figures given indicated that more than half the dried pulp produced was exported in 1926, but less than one-fourth in 1927. Further, that the home consumption in the latter year was almost three times that in 1926. Representations have been made to the British

Beet Sugar Society as to steps for popularizing this product, but the companies are carrying on a vigorous propaganda, with the result, it is understood, that practically all the pulp of the 1928-29 campaign has been booked for home consumption.

The results of experiments carried out at the School of Agriculture of Cambridge University are very instructive, and show broadly that the food value of dried sugar beet pulp is approximately 90 per cent. of that of barley meal, so that at their relative prices per ton it appears to be much the cheaper food where suitable. Investigations also have been and are being made into both the feeding and the manurial values of the leaves and crowns left on the beet fields. The Society is collecting authentic data hereon, and their conclusions will be published in due course. In a report of the Department of Agriculture of Cambridge University, the feeding value is estimated at an average of 15s. per ton, or about that of mangolds. The Oxford inquiries, based upon the opinions of representative farmers, place the average value round 37s. per *acre*. On the other hand, these opinions, in terms of comparison with other root crops, put them generally at equal or greater value than mangolds. As the tops and crowns in this review ranged from 3 to 17 tons per acre, this latter value seems to vary in the ratio of 5 or 6 to 1. Turning to manurial value, Cambridge estimates about 6s. 6d. per ton and Oxford 29s. per acre. There is obviously need for much further investigation extending over a series of years.

Succeeding Crops.—Inquiries are being pursued with a view to ascertaining the increased yields of crops following sugar beet. This is a matter of great difficulty, and divergence of opinion naturally exists. It is not yet practicable to make any authoritative pronouncement on this aspect of the subject; indications, however, generally point to distinct improvement.

Beet Seed Station.—If the industry is to be, as it should be, in a position to supply all its own needs, one of the most importance is the adequate supply of satisfactory seed, most of which is now imported. The Universities, Agricultural Colleges, and seedsmen all do valuable work, but only as an item in their many activities, whereas Continental experience points to the need for undivided attention being devoted to the selection and commercial production of sugar beet seed, a business that has become very extensive and lucrative. In its early stages, however, it seems to be essentially one to be undertaken by Government, to secure continuity, and because it takes many years to establish and bring to perfection. As long ago as May, 1913, the then British Sugar Beet Council (a predecessor of this Society) was represented on a deputation to Mr. Runciman, President of the Board of Agriculture, and presented a memorandum, but nothing more was done at that time. The Society considers this matter is one of the greatest importance.

Beet Pulp.—The Beet Sugar Factories' Committee have decided, in selling dried beet pulp to the farmer, to charge no more than 15s. a ton as a maximum for rail freight to the farmer's railway station. That is to say, that the distant farmers' who grow sugar beet under the new concession will get this additional advantage in rail carriage when they buy back dried pulp from the factory. Each contracting farmer is allowed a quota of sugar beet pulp under his beet-growing contract, and it is that quantity in respect of which this further carriage concession will operate. The price of the pulp to the grower, ex factory, under the present sugar beet contract is £5 a ton, so that the maximum price, delivered at the grower's station, of the quantity to which he is entitled, would be £5 15s.

The 1928-29 Cuban Sugar Crop.

From a Havana Correspondent.

All restriction of the output of raw sugar was removed by the President of Cuba in the latter part of 1928. He, however, expressed a wish that grinding operations should not begin until the 1st of January, and this wish was respected by all engaged in the sugar industry. During the first week of January a large number of mills started operations, and by the 15th of that month there were 155 mills manufacturing raws. Reports from a large number of the mills show that good progress, large daily outputs and very satisfactory yields have been made.

The following table gives at a glance the progress made to the 15th of January, and its comparison with previous years :—

	Sugar Mills Operating	Tons made	Yield in 96° Sugar per 100 Cane Per Cent.
1928/29	155	479,600	10·74
1927/28	(Not grinding at this date)		
1926/27	161	272,000	9·84
1925/26	155	595,500	10·34

The yield in manufacturing to date is very satisfactory and indicates that a figure above the average will be obtained this campaign. It also shows that large and perhaps record-breaking outputs will be made in some mills. With 479,600 tons made during the first 15 days of January it was evident that about 1,000,000 tons would be made by the end of that month ; actually, 1,196,000 tons was achieved, the highest on record since 1925.

There are no reliable figures on the probable output for the crop, but estimates of about 4,500,000 tons are talked about. With the high yield of sugar at present obtained, and suitable harvesting weather prevailing, that figure of tonnage yield does not seem too high, and may be exceeded.

But the low price prevailing for sugar nowadays is certainly not encouraging the cane farmers who, at present prices. can barely make a living. Notwithstanding this fact, much replanting is being done all over the Island, and it seems probable there will be no diminution of Cuba's production for some years.

In face of the low prices, economy in operating is being stressed on every hand, and every effort made to reduce the cost of production. This endeavour is also being applied to the cane plantations and, on several estates, irrigation plants are in operation, and others in course of installation. With irrigation installed, and its application understood and wisely applied, a much heavier tonnage of cane will be obtained than that achieved so far, and at a much lower cost. In fact, there will be, in some districts, an enormous production of cane at a very low growing cost, which will enable the factories to produce profitably at to-day's prices, or even less.

The present discussions in Washington on the Import Duties are being watched in Cuba with the greatest interest, and every endeavour is being made by sugar interests, growers of small fruits, merchants and others to obtain a fair and just arrangement on the duties payable on Cuban products entering the United States. Until that matter is finally disposed of, affairs in Cuba will remain in an unsettled condition; but with it settled, Cuban trade will doubtless be suitably adjusted to meet the new order of things.

Mauritius Export Duty Removed.—An Ordinance (No. 29 of 1928), dated 8th December and published in " The Mauritius Gazette" of the same date, removes the export duty of 30 cents per 100 kgs. on sugar. Any such duty which may have been levied on sugars of the 1928-29 crops will be refunded.

World Sugar Production and Consumption since 1920.

In a paper prepared for the Economic Committee of the League of Nations, dealing with the world sugar problem, Dr. H. C. PRINSEN GEERLIGS, who is one of the experts appointed to survey and report on the economic position of sugar production, analyses the sugar output, consumption, supply and shortage in the various continents since 1920. The following table is a summary of his figures, and we give also the summary of his argument.

	World Total in 1000's of Tons			
Year	Production	Consumption	Surplus	Shortage
1920-21	14,292	13,330	962	—
1921-22	14,962	16,059	—	1,097
1922-23	14,944	15,319	—	375
1923-24	16,196	16,065	131	—
1924-25	21,283	19,340	1,943	—
1925-26	21,501	20,572	929	—
1926-27	20,743	21,180	—	437
1927-28	22,554	22,084	470	—
1928-29	24,000	23,000	1,000	—
Total	170,475	166,949	5,435	1,909

1920-21.—By this year the immediate after-effects of the war had ceased to be felt, and the abnormal prices of 1920 had dropped ; and the price finally fell to below 3 cents, thanks to a plentiful crop.

1921-22.—Consumption rose while production failed to keep pace with the increase, consequently a shortage ensued. At the end of the year Cuban sugar was 3·18 cents per lb.

1922-23.—Here again there was a shortage. Production remained much as before, and consumption diminished slightly. At the end of the year there was practically no sugar left on the market, and invisible stocks were heavily drawn on. The price in New York was then 4·51 cents.

1923-24.—Production began to increase, particularly in Cuba, so in spite of greater consumption there was a small surplus. The price of sugar at August 31st was 3·88 cents.

1924-25.—A marked development of European and American beet cultivation, and an increase in Cuban production. Sugar production hence rose very considerably. Consumption aided by low prices expanded also. On August 31st the price was 2·44 cents. This year there was a large surplus.

1925-26.—The large surplus led to measures being taken to restrict production. Cuban cultivation was reduced 10 per cent. by Government action, and in Europe slightly less land was under beet. Stimulated by low prices consumption also increased, and the surplus was reduced by about half. In 1926 the price of sugar in New York was 2·50 cents.

1926-27.—Cuba again restricted output. In Europe less sugar was produced. Consumption increased. The demand exceeded supplies and a shortage resulted. Price on August 31st was 3 cents.

1927-28.—A further restriction in Cuba by 500,000 tons. But in Europe and Java a much larger crop. Consumption increased. Nevertheless there was a surplus, and the price on August 31st fell in New York to 2·34 cents.

1928-29.—Cuba will probably produce a million tons more ; both Europe and Hawaii will certainly produce more. The total world crop (excluding India's native production) may be estimated at 24 million tons raw sugar. Consumption may be put at 23 millions, which gives the year a surplus of a million tons, or exactly the amount of Cuba's increase.

But studying the Table above, remarks Dr. GEERLIGS, we note that, in nine years, with a production of 170,475,000 tons, there has only been a surplus of 3,500,000 tons. We must deduct therefrom the various amounts which

are not publicly disposed of in the interval between the delivery of the product by the grower and its receipt by the wholesale merchant at the place of destination, i.e., all that is lost by flood, fire, shipwreck, robbery, smuggling, deterioration, etc.—in other words, all the sugar that disappears from the public market. This may be reckoned as at least 1 per cent. of the total, so that the total world supplies in these nine years have only increased to the extent of 1,800,000 tons, of which 1,000,000 tons has to be reckoned in for this present year alone. We should also remember that the visible stocks in 1920 were almost absorbed, and that in 1923, also, there were practically no invisible stocks left over. Consequently, the increase after 1923, amounting to 3,900,000 tons gross (or to 2,700.000 tons after deduction of the 1 per cent. loss on the 120 million tons' consumption in the six years, 1923-24 to 1928-29) represents the total estimated final stocks on August 31st, 1929, available over the utterly exhausted stocks of 1923, which might be taken at 1½ million tons. In ordinary years these stocks may be assumed to be equivalent to 10 per cent. of the annual consumption, or to 2,300,000 tons, that is, 800,000 tons more. Hence, the total surplus in existence on August 31st, 1929, in factories, shops, packing houses and stores throughout the whole world, should not exceed 4,200,000 tons.

If the production, which in 1928-29 is no longer trammelled, and thus artificially held back, by official restrictions, is not allowed to increase suddenly in the future, but is permitted to develop gradually, it is more than probable that the steadily growing consumption will soon absorb it, and will itself account for the surplus of 1,900,000 tons (over and above the necessary reserve of 10 per cent. for consumption) which is not in itself so very formidable a figure. If however—as has happened recently— many countries increase their production, it may yet be a long while before equilibrium is restored.

Formosan Agriculture in 1928.[1]

By R. L. PENDLETON,
Professor of Soil Technology, University of the Philippines.

During the latter part of May and early June of 1928, the writer had the privilege of stopping for a week in Formosa, on his way from Japan back to the Philippines. Through the courtesy of official quarters he was extended every opportunity possible, in the short time available, to inspect the general agricultural conditions of the Island, and the research work concerned with the advancement of agriculture.

Formosa with a population of about four millions is the main tropical island in the Japanese Empire, and it supplies large quantities of sugar, rice, bananas and other tropical produce to Japan proper. There are subsidized steamer lines connecting the two, and large comfortable ships with good service are provided. Keelung is the main northern port; it has a harbour securely protected with breakwaters and there are substantial quay walls and capacious warehouses well provided with freight-handling equipment. The railroad facilities of the island impress one as being developed to meet the needs of an intensive agricultural industry; immense quantities of agricultural produce are transported, and there are frequent passenger trains; and much of the main railway line south of the capital is being double-tracked. The island is of very simple form with a wide coastal plain on the western side,

[1] A paper (here considerably abridged) contributed to the Sixth Annual Convention of the Philippine Sugar Association, 1928.

and with narrower plains on the south and valleys in the north. There are very high mountains occupying the central portion of the island, and extending to the eastern shore in many places. Highway facilities are still somewhat backward ; and automobiles do not appear to be common except in or near the main cities. But there is in existence a system of light railway lines, called push-car lines, which run along the country roads or across country, and on which light cars, pushed by a single coolie, are used. There are about 900 kilometres of such lines but no power cars are used on them. The sugar centrals, of which there are about 44 modern ones in the island, have a total length of about 1000 kilometres of railway track ; these are not open to the public as a whole and are used mainly for the transportation of cane, sugar, and other materials to and from the centrals.

One of the largest single undertakings of agricultural interest is the Kanan Irrigation project where a government private association is constructing an irrigation and drainage system to care for about 150,000 hectares of agricultural lands. This project involves the use of water directly from the rivers as well as the construction of a large storage reservoir. The entire project will cost over $25,000,000 or over $165 per hectare of land irrigated. The land owners are being assessed $2·50 per hectare per year for 10 years as their contribution. The rest of the money is being borrowed by assessments on local organizations, by loans from banks and other commercial bodies, and by gifts from the Formosan government. It is noteworthy that the amount of water available is not adequate to irrigate all of the area each year ; one-third of the area is to be in rice, one-third in cane, and one-third in sweet potatoes and miscellaneous crops. A very significant feature of the design of the system is that full provision is made for the drainage of the low-lying areas, as well as for the irrigation of crops on the same lands, thus precluding the failure that has been all too common in irrigation projects in India and the United States. Large automatic tide gates are a feature of the drainage system, for much of the agricultural land to the west is very low, and hardly above the tide level.

As an agriculturist, the thing which impressed one most was the whole-hearted way in which the Government are supporting agriculture. It is well known that Japan proper is very limited in agricultural land, and that the production from the soil has to be increased as much as possible by the use of fertilizers, improved varieties of crops, and by the control of diseases and pests. This has resulted in Japan in the development of a very extensive, elaborate, and generously supported system of agricultural experiment stations, agricultural schools and colleges, and extension agencies. This same policy of generous support has been put into effect in Formosa, where about $300,000 are spent annually for the insular agricultural research and experiment stations alone. This sum does not include the additional amount which is appropriated annually for research into the forestry, mining, electro-chemical and similar industries. The five western provinces are also active in the development of local experiment stations, which are mainly for demonstration purposes, though their work is closely correlated with that of the insular stations. There is also a very large amount of money spent for the development of the new Imperial University of Taihoku, where the teaching of agriculture will have a large place—probably about a third of the whole expense and attention of the University will be devoted to this subject, for in Japan proper the Universities place strong emphasis upon agriculture.

The agricultural experiment stations of the Government of Formosa are several. There is the central station at the capital, Taihoku, where the main

laboratories and experimental fields are located, and where at the same time the University and higher agricultural school are located, so that the same staff can perform both research and instructional functions. Then there is the temperate fruit station in the hills a few kilometres north of the capital. The tea district of Formosa is characterized by peculiar, red, acid soils, and located in the centre of this district is the tea experiment station. Work is here being done on the breeding and culture of new varieties of tea bushes, and in the improvement and standardization of the methods of the manufacture of the tea, particularly of the Oolong tea, which is produced only in Formosa. South of the upland region of the western plain is the truly semi-tropical region of the lowlands of Formosa, with the mixed culture of rice and cane, with large bamboos, bananas, papayas, etc.

Near the important city of Tainan, in this southern plain, at Shinkwa is the sugar experiment station, where a large amount of valuable work has been done on all phases of the sugar industry of the island. The chemistry of soils and of sugars, green manure crops and their effects, plant pests and diseases, and the breeding of sugar cane all receive attention. The main breeding of the sugar cane is done in Java, however, where the Formosan Government has a station in the hills, under Japanese management, and the Shinkwa station sends its canes to Java to blossom and be crossed ; Javan varieties are also used as some of the parents. As a matter of fact, some of the POJ canes are at present very popular in Formosa. The hybrid seed, when produced in Java, is sent to Shinkwa station to be germinated and grown, and the selections from the seedlings made. Several hundred crosses have already been effected and handled in this way, and the work continues. In connexion with this sugar experiment station there was formerly a school for the training of sugar technologists. A small, complete mill, of a few tons capacity, was a part of the instructional equipment. The course was discontinued and the mill dismantled a few years ago, after about three hundred students had completed the courses of instruction. The modern sugar mills had all been completed, staffed, and put under operation, and there seemed no need for the government to train additional men, particularly as the mills themselves could gradually train new men as they needed them.

Speaking of cane diseases, it is interesting to note that the sugar station pathologist admits that there are one or two serious cane diseases known in Formosa which have not yet been reported from the Philippines.

One of the most interesting projects of the Shinkwa station is the method which has been developed for the making of large quantities of manure compost, by keeping pigs in special sanitary pens, and giving them an abundance of cane trash, rice straw, or other farm trash for bedding. The resulting mixture, after further storage, has been found very beneficial for the cane soils of the region ; moreover, the method is a good one from the standpoint of hog raising. Under the Formosan conditions, it should not be forgotten that cane trash, cane roots, and cane tops all have a cash value for feed or domestic fuel, and most of the trash and stubble, when ploughed out, is saved for fuel, being carefully stacked up and protected until needed.

Soil surveys may be mentioned as an indicator of the degree of advancement of the study of the soils of the Island. Practically all of the lowland agricultural soils have long ago been mapped by the Experiment Station, the coloured maps published, and the soils studied thoroughly in the laboratory and greenhouse, as well as the field. There have also been published elaborate illustrated reports of several hundred pages each, upon the field characteristics and needs of the soils, the methods of fertilization, and other factors of interest

and importance. To supplement these surveys a number of the sugar mills are reported to be making detailed soil surveys and other studies of the soils of their individual districts.

The main agricultural crops of the Island are rice, sugar cane, sweet potatoes, tea, peanuts, as well as considerable quantities of bananas, and some jute, ramie, etc. Sugar, which interests us the most, is grown very largely in competition and in rotation with rice. It seems that it is often more profitable for the farmers to grow rice than sugar cane, and in the absence of long term contracts for the production of cane for the mills, the latter are reported to be finding it difficult to obtain the cane that they need for the satisfactory operation of their plants.

A SUMMARY OF SUGAR CANE AND SUGAR PRODUCTIONS IN FORMOSA.

(*Converted from the Formosa Official Returns*).

Year.	Total Area in Cane, Hectares.	Total Cane Production, Metric Tons.	Cane used for Sugar Mfre. Metric Tons.	Sugar Produced, Metric Tons.	Cane Yield per Hectare, Metric Tons.	Tons of Sugar per 100 Tons Cane Milled
1902-1903..	16,029 ..	409,895 ..	409,895 ..	30,408 ..	24·06 ..	7·42
1903-1904..	20,944 ..	644,985 ..	644,985 ..	45,501 ..	28·97 ..	7·05
1904-1905..	24,225 ..	643,334 ..	643,334 ..	49,580 ..	24·98 ..	7·71
1905-1906..	34,100 ..	1,014,124 ..	1,007,548 ..	76,433 ..	27·98 ..	7·58
1906-1907..	29,476 ..	830,189 ..	818,157 ..	63,877 ..	26·50 ..	7·81
1907-1908..	27,840 ..	851,316 ..	841,905 ..	65,521 ..	28·77 ..	7·78
1908-1909..	37,860 ..	1,331,683 ..	1,331,683 ..	122,328 ..	33·09 ..	9·19
1909-1910..	61,502 ..	2,160,898 ..	2,018,015 ..	204,241 ..	33·05 ..	10·12
1910-1911..	86,753 ..	2,829,153 ..	2,656,080 ..	270,339 ..	30·68 ..	10·20
1911-1912..	73,062 ..	1,895,759 ..	1,731,095 ..	175,587 ..	24·41 ..	10·14
1912-1913..	65,331 ..	918,311 ..	769,848 ..	71,490 ..	13·22 ..	9·29
1913-1914..	73,981 ..	1,585,570 ..	1,402,113 ..	150,768 ..	20·16 ..	10·75
1914-1915..	82,587 ..	2,360,283 ..	2,144,274 ..	208,468 ..	26·89 ..	9·72
1915-1916..	111,006 ..	3,441,131 ..	3,220,998 ..	321,064 ..	29·16 ..	9·97
1916-1917..	125,759 ..	5,092,870 ..	4,773,426 ..	458,094 ..	38·10 ..	9·60
1917-1918..	145,921 ..	4,090,521 ..	3,755,923 ..	344,123 ..	26·37 ..	9·16
1918-1919..	116,886 ..	3,378,803 ..	3,115,685 ..	291,814 ..	27·22 ..	9·37
1919-1920..	105,114 ..	2,629,504 ..	2,322,776 ..	223,210 ..	23·53 ..	9·61
1920-1921..	116,279 ..	2,962,994 ..	2,689,193 ..	252,734 ..	23·97 ..	9·40
1921-1922..	137,757 ..	4,051,703 ..	3,715,254 ..	352,655 ..	27·67 ..	9·49
1922-1923..	113,109 ..	3,979,118 ..	3,715,224 ..	355,392 ..	33·10 ..	9·56
1923-1924..	119,524 ..	4,676,213 ..	4,397,013 ..	452,210 ..	36·81 ..	10·28
1924-1925..	126,448 ..	5,303,900 ..	4,917,911 ..	479,540 ..	39·46 ..	9·75
1925-1926..	120,221 ..	5,116,068 ..	4,786,861 ..	499,926 ..	40·43 ..	10·43
1926-1927..	96,689 ..	4,452,288 ..	3,994,039 ..	411,140 ..	43·32 ..	10·30

The Government has done a great deal to encourage the establishment of the cane sugar industry, and the extraordinary development that has resulted has attracted much attention in other sugar growing regions. The suitable cane producing regions have been apportioned to the several companies so that there would not be competition between the mills for cane, nor duplication of railways, or other needless expense. Some of the mills are said to be operating at least partially on the administration system of cane production, while others buy the cane outright from the actual farmers. In the question of land tenure, and in obtaining the assistance of the cultivators, there has been much official assistance. The precise nature of the relation between the mill

and the producer of cane is at times involved. It is understood that the mills purchase the cane on weight alone, without any analysis of the juice for the planter. The cultivators all use commercial fertilizers, for the mills purchase these in quantity for all the cane cultivated in their district; the fertilizer is delivered to the cultivator, and its cost deducted from the amount due the cultivator for the cane delivered.

Green manures are said to be widely used, possibly as much as a third of the entire cane area being so treated. It was interesting to see a single ploughman and a carabao, with an ordinary country plough, actually doing a good job of turning under a green manure crop.

The phenomenal growth and present condition of the sugar industry of Formosa is shown at great length and in amazing detail in the annual report of the industry. This is a publication of over 240 pages. Being in Japanese, it is largely unavailable to the the Occidental. The writer has been fortunate, however, in obtaining a translation of the headings of a summary table of this publication and has converted into metric equivalents the values stated therein. The values given do not agree with some seen in other publications, but are offered as a contribution to the scanty data available to the average reader of sugar publications.

A number of the mills produce a white sugar in connexion with the milling of the cane, though the amount so produced, or the methods used, was not learned. In some cases there is a large production of ethyl alcohol by distilleries located at the sugar mills. At the time of our visit the milling season was almost over, so that we did not have an opportunity to inspect a mill in operation.

One more function of the Government in the encouragement of the sugar industry should be mentioned. At the southern port of Takao is a sugar laboratory where certificates are issued as to the quality of the sugar that is being shipped. This laboratory also maintains a shop where polariscopes and other optical instruments are repaired and adjusted.

The heavy protective tariff on sugar to be used for consumption in Japan determines that practically all of the Formosan sugar is sent to Japan proper for consumption. Not only is there the duty on foreign sugar, which amounts to several pesos a picul. but there is a very heavy sugar consumption tax on all sugar used in Japan, which very materially increases the price to the consumer. Such of the Formosan sugar which is not made directly into white sugars is refined in the port cities of Japan, mainly in Osaka and Kobe. These same factories import very large quantities of Java raw sugar, refine it, and export it, mainly to the Asian mainland, without paying the high duty or Japanese sugar consumption taxes.

Despite the heavy investments which the Government has made in research for the sugar industry, there are large agronomic problems still facing the sugar industry of Formosa, and it will be very interesting to see what ways will be evolved for the decrease of diseases, and the increase of tonnage per hectare. Serious research is proceeding at the Shinkwa station and what is being done there is well worthy of attention. There is no doubt but that intensive study of that work would amply repay investigation. Voluminous reports are being issued, which contain many valuable data, but the written language is too difficult for us. Personal study and inquiry would enable us to gather a great deal which, though naturally not often of direct applicability to other local conditions, would be of immense help in the solution of the problems that arise.

The Cultivation of Sugar Cane in the Argentine Republic.

By WILLIAM E. CROSS, Ph.D.

The province of Tucumán is the chief sugar producing State of the Argentine, having nearly 130,000 hectares under cane. Jujuy comes second with 15,000 hectares, and Salta with 5000. A small amount of cane is also grown in the Chaco, Corrientes and Santa Fé, sufficient in each case to supply one factory. Tucumán has 28 factories, Salta two, and Jujuy three.

Tucumán is situated in the north-western part of Argentina; in its western half it includes some of the higher mountains of the Andes, which also send out branch chains over the northern part of the province. The eastern part of the State, except in the north, consists of a flat plain. Sugar cane is grown principally at the foot of the western mountains, and in the western part of the plain, these being the sections which receive the greatest rainfall, and are generally the most fertile.

Jujuy and Salta are adjoining provinces to the north of Tucumán. Except for the southern part they are mountainous, with picturesque fertile valleys. The sugar cane is grown in these valleys and in the plains.

All the sugar plantations of the country lie between latitudes 23° and 28° South, the Tucumán cane belt being between 26° and 28°; Jujuy, 24°, and one of the ingenios in Salta being in latitude 23°. It is to be noted, though, that all the land is at a considerable height above sea level (Tucumán averages 1200 feet in the cane zone, and the other two provinces rather more) and that it is situated at a great distance from the sea, having thus a "continental" climate, with considerable extremes of heat in summer and cold in winter.

An idea of the climatic conditions may be gained from the average data, given in Tables I and II.

TABLE I.

Average Rainfall Statistics in Tucuman, Jujuy and Salta (m.ms.)

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Tucuman (average 34 years)	191	172	159	62	23	14	12	11	15	59	103	153	974
Jujuy (average 8 years)	168	103	150	38	11	5	5	6	11	48	68	130	743
Salta (average 34 years)	136	117	100	28	5	1	1	2	7	16	61	97	571

From these tables it will be seen that there is a distinct rainy season from November to March, and a dry season from May to September; and that there is a very definite, rather cold winter season, with occasional temperatures below zero. It is for this reason that the cane has to be harvested annually, during the dry winter season.

The attitude towards the freezes is different here from that in Louisiana. There an attempt is made to get the greater part of the crop over before the middle of winter, when the worst cold spells are expected, whereas in Tucumán the ingenios begin their harvest almost in the middle of winter, in the month of June, being willing to risk losses by frost damage on the chance that, if freezes do not come, the cane will be able to ripen better, and thus give more sugar per ton. Another important factor is the pernicious effect of early cutting on the stubble yields; for by commencing the crop late, even if they suffer losses from frost they at least maintain their stubbles in good condition for the coming years.

The crop usually lasts some four months, but in case an exceptionally heavy yield of cane is obtained, the harvest is continued until the rainy season begins when the state of the dirt roads makes the regular transport of the cane impossible.

The greater part of the cane plantations are on fairly level lands, but the lower slopes of the hills are also planted in cane to some extent, as there are zones on the hillsides which are practically frost-free even in the coldest years. Moreover on these slopes the rainfall is usually considerably higher than in the plains.

The soils vary considerably in different parts of the cane zones, but generally are loams or sandy loams of high fertility. The newly deforested lands are very high in humus, while those which have been under cultivation for many years are sometimes rather poor in this important constituent. In Tucumán especially there are sections where the soils have been continuously under cane for a long period of years and are suffering from the lack of proper soil conservation ; nevertheless, it is surprising how many soils have resisted this ill treatment and are still remarkably fertile.

TABLE II.*

Maximum and Minimum Temperatures in Tucuman, and Jujuy (Degrees C.)
(Average of Ten Years.)

TUCUMAN—	January	February	March	April	May	June
Average maximum	31·2	29·9	27·6	24·0	21·6	18·8
Average minimum	18·6	18·9	17·7	14·2	10·7	7·2
Absolute maximum	44·4	44·0	37·8	35·2	32·0	33·8
Absolute minimum	11·2	9·9	8·0	4·0	0·2	—3·2
	July	**August**	**September**	**October**	**November**	**December**
Average maximum	20·0	21·1	26·0	27·9	28·9	30·6
Average minimum	6·0	6·5	10·8	13·6	16·2	18·3
Absolute maximum	37·3	36·7	41·2	41·2	41·3	41·0
Absolute minimum	—3·2	—3·0	—0·6	2·1	7·2	8·2

JUJUY—	January	February	March	April	May	June
Average maximum	26·4	26·5	24·7	21·0	18·9	17·1
Average minimum	15·7	17·0	16·2	13·2	10·2	7·3
Absolute maximum	33·5	34·6	33·5	27·5	28·0	28·5
Absolute minimum	10·5	10·4	9·0	3·5	0·5	—1·5
	July	**August**	**September**	**October**	**November**	**December**
Average maximum	18·6	19·3	23·2	25·4	26·7	28·0
Average minimum	7·6	7·6	11·4	13·6	15·2	16·2
Absolute maximum	33·0	32·5	35·0	36·6	38·0	38·0
Absolute minimum	—2·0	—2·0	1·0	4·0	6·4	9·0

The soils in general are rich in potash, and rather poor in phosphoric acid and lime.

The preparation of the land for planting cane is carried on in the usual way : the ground is ploughed and harrowed twice or three times, the direction of the ploughing the second time being usually perpendicular to that of the first and third working. The standard kinds of ploughs and disc and tooth harrows are employed, drawn by the small local mules. Some three or four of the ingenios have steam ploughing equipment, which gives excellent results. Tractors are used only to a small extent, mainly owing to their high cost and that of gasoline, oil and spares in this country. Little progress has been made in the use of alcohol as fuel for tractors.

* The temperature data of the different plantations vary considerably, owing to their different situations, with respect to the mountains, height above sea level, etc.

The Cultivation of Sugar Cane in the Argentine Republic.

In recently deforested land the cane furrows are sometimes made without previously ploughing up the whole land; the middles being afterwards ploughed up when cultivation begins. That this method can be used with success is probably due to the high humus content of the soils, which makes them extremely friable.

There is practically no cane planted in squares or holes as in some countries, the planting in rows being preferred. The rows are always of approximately one hundred metres long, this row being considered as a unit in this country, the amount of cane planted being referred to as so many rows, and the cost of cultivation, yields, etc., being also figured on this basis. There is usually a road or headland running along both ends of the rows. A "tablon," or plot of cane, consists of a certain number of rows, usually around two hundred and fifty. The "tablones" are usually divided one from the other by roads.

The rows are almost always laid out to run north to south, the reasons given for this being that in this way the cane resists better the frequent strong winds which come in the autumn when the cane is tall, and also that in this way "the cane receives the sun equally on both sides." Perhaps the real reason, however, is that in most districts the land slopes from east to west, so that the rows are rightly placed from north to south to prevent erosion. And as a matter of fact, when the cane is planted on the hillsides, the rows are made as level as possible irrespective of their general direction.

The best time for planting is in June, July and August, but sometimes earlier plantings are made (April, May) and in years when it does not freeze a certain amount of planting goes on until the end of October. The Experiment Station has recently recommended the planting of cane in the summer (Jan.-March) with the idea of obtaining a good stand of cane before the winter cold comes on. Experiments carried on during a series of years have given very favourable results with this method.

With the old native canes, the distance of planting was usually between 1·50 and 1·66 metres, and the POJ canes are planted at only slightly more than this distance in Jujuy and Salta. In Tucumán on the other hand, between 1·80 and 2·0 metres is the distance usually employed.

When the cane is planted without ploughing in the recently deforested lands, the rows are opened up by spade work only, and this method is practised to a slight extent in ploughed lands. Usually, though, the work is done mainly by double mould-board ploughs. The rows are first marked out with a small plough, and then opened up with a large double mould-board plough, which is passed two or three times through each row in order to give it the required depth. The rows are then, frequently, cleaned out with the spade, leaving on the bottom a certain depth of loose soil.

For planting, whole canes are generally used, though tops may be employed if the cane is planted in September or October, with irrigation, when immediate sprouting is desired, which is not the case with the winter plantings when the cane should lie in the ground in a dormant condition until the danger of frost is past. The cane is planted in two continuous lines in the row, sometimes even two and a half lines being used if the material is not in the best condition.

Not much is done in the way of selection of cane for planting, although the Experiment Station has repeatedly indicated the desirability of only planting the healthiest, most vigorous cane, and also that which is of the deepest purple colour, for it has been shown that with both the POJ 36 and

213 the intense purple colour is accompanied by greater general vigour and higher yields.

The amount of " seed " required per row depends upon the variety, about 150 kilos being necessary with the native cane and the POJ 2725, and around 120 kilos with the POJ 36 and 213.

If the cane is to be planted after the season when freezes may be expected, sometimes it is cut and piled up, the piles being covered with trash and earth to protect them from drying out. Many planters on the other hand " take a chance " on the frost, and if freezes do come, either postpone their new planting till the next year or obtain " seed " from some plantation, usually on the hillsides, where freezing temperatures have not been experienced.

With the native cane it was customary in all cases to let the cane dry out a little before planting; but with the POJ canes it has been found that the best results are obtained if freshly-cut cane is planted.

The covering of the planted cane is done by spade, or by a small plough. The small cultivators of the Planet Jr. type have an attachment for covering the cane from both sides of the row, and this is recommended by the Experiment Station and also used to some extent in the industry. The depth of covering-earth depends upon the time of planting. For cane planted in the autumn or early winter it is necessary to prevent immediate sprouting and protect the planted cane from the cold, drying out, etc., and for this reason some five or six inches of soil is the usual covering; while if the planting is done in late winter or in spring, some three inches of covering soil is sufficient. In the early plantings the soil is frequently pressed down by a small roller, to aid in preventing the drying out of the " seed."

The aim of the first cultivation of the plant cane, which begins in September, is to obtain well filled rows, i.e., as far as possible to get every bud to sprout. The first operation is to weed the rows, and at the same time to take away such an amount of soil that the cane will only be lightly covered, the amount of soil having to be removed in this way being greater in the early than in the later plantings. This operation is carried out with spades, with which also the depth of the cane is " felt " here and there by pressing them down vertically in the soil, thus determining how much soil should be removed.

As the cane sprouts, another weeding with spades is necessary, and on this occasion the depth of the cane is also " felt " with the spade in any part of the row where the cane is not coming up, to determine whether too much earth has been left in that particular place, in which case the excess is removed.

Soon after this, the cane should be well sprouted, when a certain amount of earth is thrown to it by means of a plough, a disc cultivator straddling the row, or a disc harrow going through the middles. Later on, when the cane attains a height of three or four feet, earth is thrown to the row a second time, and the cane is " laid by."

During all the time the middles are kept clean by suitable cultivation, the small cultivator of the Planet Jr. type, and the reversible disc harrow being the two types of implement mainly employed. The Planet type implement is used with various types of teeth, small shares, etc., five or seven being used according to the width of the row. By fitting it also with two special shares, it is sometimes used to throw earth to the rows. It is generally drawn by one or two mules. The reversible disc harrow, with six discs, has attained much popularity in cultivation. It requires to be drawn by four mules, but does better work than the smaller cultivator. The discs can be turned inwards, to throw earth towards the centre, or outwards, thus throwing earth to the cane.

In many cases all the hilling up of the cane is done with one or other of these two implements.

Once the cane is " laid by," no other treatment is given to it until the harvest, such processes as stripping or "tying," etc., used in some other countries being unknown in the Argentine.

Great care is lavished upon the planting of the cane, and the cultivation during the first year, for the purpose not so much of securing heavy " plant " yields, as of obtaining well filled rows of healthy plants which will mean high tonnages during the six to ten stubble years the cane is expected to give. For this reason also the cultivation of the stubble cane is carried out with great care, especially the treatment of the stubbles in the spring.

After the harvest of the plant cane the trash is usually left on the fields until the end of August, as the planters believe that it protects the stubbles against frost. The trash is then burned on the fields in the way common in many countries. If the cane is harvested later than the end of August, the trash-burning takes place as soon as the material is dry enough to burn.

The first step in the cultivation of the stubble cane is to open up the middles either with a double mould-board plough, or by passing twice in opposite directions with a single mould-board plough. The cane is then " off-barred," either the two sides being done at once with the " Horner " two-disc implement, or else a single mould board plough, often provided with a vertical knife is passed down each of the two sides of the row. Then comes an operation which is carried out by spades or hoes, which is called the *desaporque*. This consists of removing as far as possible all soil from around the cane stubbles, leaving them exposed for a few days to the air and sun. This operation is expensive, as it costs between $0·40 and $0·50 Arg. currency (8d. to 10d.) per row, but the majority of the planters insist that it prolongs the life of the stubbles as well as giving higher yields of cane. It would appear to have been the practice, also, years ago in Louisiana, as Dr. W. C. STUBBS, in his book " The Sugar Cane " says :—" Formerly the stubbles were dug with grubbing hoes down to the mother cane and left shaking in the breeze." The Experiment Station has recommended that this *desaporque* be replaced by treating the stubbles with the stubble-shaver and stubble-digger, which its experiments have shown to give the same results at much less expense, and this advice is being followed more and more among the planters, although the spade method is still the more generally used.

The initial cultivation of the stubble rows being carried out in this way, the middles are harrowed with a tooth harrow, leaving the soil nicely mulched.

The subsequent treatment is similar to that of plant cane. A few days after the *desaporque* or stubble-digger treatment, earth is thrown to the cane by means of the implements already mentioned, and when the cane is three or four feet high, the operation is repeated, and the cane " laid by." This hilling up of the cane every year makes the rows tend to take the form of rather high ridges, but this " climbing " is offset to some extent by the *desaporque* or stubble-shaver treatment, by which a good part of the earth added during the previous year is removed. The middles of the stubble cane are cultivated in exactly the same way as with the plant cane.

In the cultivation of practically all the cane of Jujuy and Salta, and more than half that of Tucumán, irrigation is practised. For this purpose only river water is used, the country having numerous rivers and streams. Some of them have irrigation dams, from which the irrigating canals run to the adjacent plantations, but in many cases the water is taken from the rivers

by more primitive means, i.e., by making a canal which leads out of the river at a given point, and takes off a part of the water. The quality of the water is usually excellent, except in the early spring, when as the result of the long dry winter the rivers are very low, and the water rather highly charged with chlorides and sulphates. It is at this time too, when irrigation is most needed, that the supply of water is scarce, so that very few plantations have really sufficient irrigation water for the best results during this period of the year. This comparative scarcity of the water available for irrigation has led to the projecting of various schemes for damming other rivers, and indeed if these schemes were put into effect a very much larger quantity of water would be available all the year round for the irrigation of cane and other crops.

In the irrigation of the cane the water is led from the main canals to channels running along the higher end of the cane rows, from which the cane is watered, generally three or four rows at a time. Seeing that the rows are usually higher than the middles, these are filled with all the water they can hold, having been previously banked up at the far end. In the plant cane, on the other hand, the rows are lower than the middles, at least until the "lay-by," and it is the rows therefore that receive the water. The irrigation is applied to the cane as frequently as the supply of water permits, according to the necessities of the season, for it will be understood that in this country of fairly heavy rainfall the purpose of irrigation is only to supplement this. Generally the plant cane is irrigated immediately after the rows are opened up, except in years of early rains, and if possible one other irrigation is given during the germination period. Thereafter the watering is given as necessary, according to the rains. Sometimes the months of October and November are very dry, when the cane receives as much irrigation as it is possible to give it with the water available ; other times partial droughts occur in January, when irrigation is again resorted to. In general, it is endeavoured to employ the irrigation to supplement the rainfall in such a way that the cane will always have available an ample sufficiency of water, and if this end is not attained completely, it is due to the insufficiency of water for the purpose.

Practically no chemical fertilizers are used in the cultivation of cane in the Argentine. This is due in part to the fact that the soils are generally rich enough to produce good crops without manuring, and in part owing to the high cost of fertilizers here, seeing that they have to be imported from foreign countries, and have to pay the long freight haul from the ports. The Experiment Station has shown that, as in other countries,the nitrogenous fertilizers give good returns, but no increased yields have been obtained from the use of phosphoric acid or potash fertilizers on the average soils here. Even with the nitrogenous fertilizers, under our sub-tropical conditions the increased yields of cane are almost always accompanied by a certain decrease in the sucrose content and purity, which to some extent counterbalances the greater tonnage.

It is thought, though, that once the present super-production crisis is over, the use of nitrogenous fertilizers will slowly become more general, especially because of the possibility this offers of producing more cane within a short radius of the ingenio, and thus reducing the expensive rail and road freights on the raw material.

Such "natural" fertilizers as are available, such as stable manure, filter-press-cake, etc., are usually utilized as fertilizers, and give good results, though of course they do not suffice to manure more than a small fraction of the cane acreage.

It cannot be said that the cane agriculture of the Argentine has as yet been established on the basis of rational crop rotation. It is not at all uncommon, that land which has given eight or ten successive stubble crops of cane be ploughed up and planted to cane again immediately, and it is remarkable how the land stands such severe treatment. In many cases, though, the land is allowed to lie fallow a year or two before the new planting is made. Some of the planters practise rotation with alfalfa, and this gives excellent results. The Experiment Station for many years now has recommended the use of alfalfa for long rotations, and cowpeas and velvet beans as summer crops, as well as hairy vetch, Hubam clover, etc., as winter crops, for shorter rotations of one year ; and a certain number of the planters put into practice these recommendations. although they are a minority of the whole. Little by little, though, as the neccessity of maintaining soil fertility is being felt, rotation is becoming more and more a part of our agricultural practice.

The varieties of cane usually planted are the POJ 36 and 213, the former being the most popular cane in the country. The POJ 2725, now recommended by the Experiment Station, is being planted more and more every year. No other variety is planted in any great extension, although some of the planters have a fair number of rows of POJ 234, Kavangire. POJ 228, 33, 979, 2714, and Yon Tan San. The old native cane is now almost extinct.

As to cane diseases, there are few of importance in the Argentine, sereh, gummosis, Iliau, Fiji disease, mildew, leaf scald. and black smut being apparently absent, and the top-rot (*polvillo*), mosaic disease, and root rot being almost the only diseases of any importance in their effects on the cane. Rind disease (*Melanconium sacchari*), and Ring spot (*Leptosphaeria sacchari*) and various other minor leaf diseases, have been reported. Pineapple disease (*Thielaviopsis paradoxa*) and Red Rot (*Colletotrichum falcatum*) have also been encountered, but their distribution is limited to certain small zones.

Regarding animal pests, considerable damage is done to the cane by the *oculto* (*Ctenomys brasiliensis* Blainville, and other species of the same genus). The various species of field rat (*Mus rattus* L ; *Mus tectorum*, Savi ; *Mus musculus* L. ; *Oryzomys longicaudatus* Bennet ; and *Eligmodentia bimaculata*) also do damage, especially in the recently deforested regions, or in those zones where the cane lands are adjacent to such regions. Some of the factories fight the rats on a large scale with the Liverpool virus, with very satisfactory results.

The chief insect pest is the cane borer (*Diatraea saccharalis* Fab.) which produces more or less damage to the cane in the different zones. Another, probably new, species of *Diatraea* has recently been discovered in Jujuy by Mr. Harold E. Box, the Entomologist of the Experiment Station. The so-called mealy bug is also found, but the damage it may do has not yet been determined. Of the other insects which do a certain amount of damage to the cane no complete list is available, but in any case they are to be classed as pests of a minor order. Sometimes the cane plantations are visited by locusts, but in general the loss from this cause is only slight.

Of noxious weeds, the Johnson grass (*Sorghum halepense*), Bermuda grass (*Cynodon dactylon*), and the *Juncea* (*Cyperus* sp.) (nutgrass) are the only pests which are regarded seriously by the planters. The *Juncea* is not very widely established in the cane fields as yet, being mainly a pest of orchards, but the Johnson grass and Bermuda grass are almost universal. They do not cause much trouble where the ground is thoroughly prepared before planting, and

clean cultivation is practised, but once they get well established in a cane field they cost a lot to keep under control.

The harvesting of the cane is carried on from the latter part of May until September or October. The cane cutters first fell a certain amount of cane, using a *machete* for this purpose, and then with large knives proceed to strip the same and top it for the mill. This is different from the method in vogue in Louisiana and some other countries, where each stalk is stripped, topped and felled in one operation. The cutters are paid at the rate of so much per ton, for which the cane must be properly stripped and topped and handed in bundles " at the wheel " of the cane cart, to the man standing inside who receives the cane and arranges it in the cart. These cane carts are very large, holding between 2500 and 3000 kilos ; they have only two wheels, but these are nearly two metres in diam. No mechanical loading devices are used in this country. Almost universally, the chain sling system is used for transferring the cane. The chains are laid in the cart previous to loading, and then placed around the cane in such a way that the load forms one large bundle. Transferring the cane from the cart to a railway car, or to the cane carrier, simply consists of lifting this bundle with a hoist, and placing it where it is required. When the bundle is placed upon the cane carrier, a blow at the hook which holds it together is sufficient to loosen the chains, which then are lifted free from the cane by the hoist.

The carts take the cane either directly to the mill, or to one of the many railway sidings provided with a hoist, where it continues its journey to the factory by rail. Some of the factories possess railways of their own, both standard gauge and narrow gauge being found. The portable Decauville system, in which the track is laid in the cane fields themselves, is used by only one or two ingenios.

The POJ canes planted here suffer a rather rapid inversion after cutting, for which reason it is necessary that there should be no delay in milling them once harvested. An effort is made in the industry to mill the canes at least within 48 hours of cutting, though for one reason or another this is not always possible, and in consequence losses ensue.

Finally, it should be said that practically all work connected with the growing and harvesting, etc., of cane is paid for by task, at so much per ton, per row etc., and not on the basis of daily wages. This system is very satisfactory in its results, and the worker receives exactly what he earns, and the planter knows in advance the cost of the cultivation, etc., he gives to the cane. Of course the work done is always inspected before being accepted and paid for, and work which is not properly done has to be brought up to standard before payment is made.

Apart from a small number of steam ploughs, all agricultural work is done with mules, which work the ploughs and cultivators in the growing season and draw the carts in the harvest. The mules are fed with feeds produced mainly on the plantation itself, alfalfa, Rhodes grass, maize, molasses, and (during the crop) cane tops being used principally.

THE PHILIPPINE 1927-28 SUGAR CROP.—According to the figures supplied by the Philippine Sugar Association, the final output of centrifugal sugar for the crop year 1927-28 in the Philippine Islands amounted to 574,715 metric tons. In addition there was 54,117 tons of muscovados and 8000 tons of refined, making a grand total of 636,832 metric tons, or 622,700 long tons which compares with 584,238 long tons in 1926-27. The centrifugal output as compared with 1926-27 was some 40,000 tons higher. The preliminary estimate for the 1928-29 crop is put at 670,000 metric tons (660,000 long tons), of which 615,000 tons are expected to be centrifugals.

Recent Work in Cane Agriculture.

TWENTY-EIGHTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS, QUEENSLAND, 1928.

The Report by H. T. EASTERBY, the Director of this Bureau, shows a very definite step towards the improvement of plantation work in Queensland. It has often been pointed out that the cultivation practices of the 7000 cane farmers, many of them with little capital, leave much to be desired ; and for years past the Director has protested against the false economy of increasing production by extending the acreage beyond the limits of good cultivation. However rich, for instance, the soil in the sugar belt may be at the start, it cannot long retain its fertility under a crop like sugar cane, when less than a quarter of the farmers manure their land. And it has been pointed out to them that the true line of economy in plantation work lies rather in the diminution of the acreage planted in cane, so that it may be possible to reduce the heavy costs of white labour, and at the same time reap the same crops by the much less costly intensive cultivation to which the sugar cane has become accustomed. But mere advice of this description has proved insufficient, being met by the ready answer of immediate costs where there is no capital—indeed it is rarely followed ; but the development now forecasted aims at bringing this principle home to each and every farmer individually. Fundamentally, it is a new introduction of co-operation in the fields, between the cane farmer and the trained officers of the Bureau ; and this has rarely failed, even among savage tribes.

Some five years ago three research scholarships were awarded by the Bureau : graduates were selected from the local University with some knowledge of the sugar industry, and after a short preliminary training on the spot these were sent abroad for three years, chiefly to the seats of sugar research in the New World. These have now returned and have been placed in charge of sections devoted to their special lines of study ; one in charge of sugar mill technology, a second devoting his energies to the serious matter of diseases in the fields, and the third to the great allied subjects of soils and agriculture. But these men do not return to find themselves in solitary command of departments yet to be created. Strenuous efforts have been made during their absence at forming small compact bodies already hard at work on preliminary investigations. This has been especially so in the Pathology section, in which a number of men trained in the university and in the fields have been studying all sides of the question, every one of whom has also had the advantage of special attention from D. S. NORTH, the eminent pathologist of the Colonial Sugar Refining Company.

Two new Divisions accordingly appear in the Report under consideration, keeping the hitherto rather isolated and anomalous Division of Entomology in countenance, namely, Pathology and Soils and Agriculture, as already indicated. The mill technologist is not in charge of a Division, but is very busy visiting all the mills and bringing his experience to bear. We are here concerned chiefly with the plantation side of the work, and some reference will be made to the reports of the two new heads of divisions. Work on improving the cultivation of the farmers is of course of long standing, and the Director has three field assistants constantly travelling over the cane belt ; besides the various experiments on the three stations. H. W. KERR had a distinguished career at Wisconsin University and, being engaged on an important piece of research there, did not arrive till a month or two before his report was called for. But there is enough of interest in his remarks on the places he was able to visit. With economics as the basis and the domination of the high costs of white labour, he points to the absolute necessity of introducing labour saving devices.

By cultivating 100 acres the grower will barely afford to pay for his labour, while with the same expenditure on 40 he will reap a substantial profit. But such a change requires a careful study of the factors involved. Water supply is the limiting factor in one district visited, and he reviews some of the methods to be aimed at—dry farming, ratoon treatment, green manuring, molasses as manure and so forth. In another district the soil is good but shallow, and the gradual incorporation of the subsoil is called for ; the more extended use of fertilizers and by-products of the factory is suggested, and the exploitation of such additional water supplies as are possible. A third district is unique in that irrigation is carried on as a general practice ; but the many faults show that there is great room for improvement in the application of the water. As an example may be mentioned an improved sprinkler for overhead irrigation, which Kerr brought from Hawaii and saw actually at work; the probable limiting factor here was considerered to be the cost of installation, but accurate details are to be obtained. But the most important item in this report is the definite commencement of a scheme of experimental work in close touch with the farmers on their own land. This is of course not altogether new anywhere ; but there appears to be a promise of a great extension with a much closer co-operation and supervision by the new department than hitherto, and by next year it is hoped the work will be well started : the planters appear to be very favourably inclined to such a move.

The work in the new division of Pathology is under the charge of A. F. BELL, who has completed his studies in Great Britain, America, and the chief sugar cane countries of the world. The somewhat mysterious changes in the officers reporting on cane diseases during the past few years are presumably now at an end ; and we recognize the value of this all round training of the staff, mostly completed but not altogether so at the time of writing the report. The result is that the new officer in charge has not only a compact and useful number of helpers, but also a mass of painfully collected information of the distribution of the chief cane diseases in the sugar belt. Gumming continues to be the major cane disease in Queensland, and most attention is being paid to it. The introduction of tolerant if not actually immune varieties is the line of least resistance, whether through raising fresh seedlings or a re-shuffling of those already grown ; but the immediate need is for the location and founding of disease-free seed nurseries, whether by a system of certificates to farmers in healthy areas or the actual laying down of nurseries in isolated spots. It is recognized that for a long time the officers of the division will have to be more or less content with collecting and filing information, rather than issuing directions as to procedure. An urgent necessity is the formation of a garden, for the collection of varieties entirely free from disease; and at present about twenty varieties have been got together for this purpose. For the more accurate study of the cane diseases it is urged that each sub-district should have an assistant. This is the right way, and will probably be found to be a paying proposition, just as the Colonial Sugar Refining Company has an agriculturist stationed at each of its mills, an example which might be followed all over the cane belt.

A REPORT ON THE SUGAR CANE MOSAIC SITUATION IN FEBRUARY, 1924, AT SOLEDAD, CUBA. **E. M. East and W. H. Weston, Jr.** *Contributions from the Harvard Institute for Tropical Biology and Medicine*, I. 1925.

This paper, which has apparently only recently been distributed for reviewing, is an interesting contribution to mosaic literature. It is extremely well written by a couple of trained botanical investigators on the professional

staff of Harvard University ; and presents an ordered account of sugar cane mosaic as known in the literature a few years ago. The essay is moreover printed in good large type and is glorified by a handsome binding, alike somewhat unusual in tropical agriculture. It was based on an informal report prepared for the benefit of a local planter, who had spent many years at Soledad both in growing sugar cane and in studying it ; but at his request it was published, with the idea that it should be more widely known.

A great deal more is now known about mosaic in the sugar cane than when this report was written, although it is doubtful if any fundamental advances have been made ; and we shall therefore rest content with giving a summary of an interesting chapter on the different forms of chlorosis met with in plants, which was interpolated by the authors, " both because there is a tendency among the field men to confuse with cane mosaic various types of chlorosis due to unrelated causes, and because the interference with the normal chloroplastic activity that is caused by mosaic is not proved to be necessarily injurious to the plant." It may be added that the authors saw no reason to suppose that the mosaic at Soledad was causing any appreciable damage, and that it appeared likely that this position might be maintained for many years to come.

Speaking generally, the authors report, there are two colouring matters in plants, a series of water soluble pigments known as anthocyans, giving the reds and blues of flowers and fruits, and another series of only slightly soluble yellows and greens found connected with small bodies called chromoplasts lying outside the nucleus of the cell. When the latter are deficient, the plants are said to be chlorotic or suffering from chlorosis. In the leaves of most plants four pigments are commonly found, a pair of yellow ones, carotin and xanthophyll, and a pair of greens, termed chlorophyll *A* and chlorophyll *B* of uncertain constitution, but separable by their solubilities. These latter, either one or both, are necessary for the leaf to function properly ; and their presence may be interfered with by the environment, as in malnutrition, by hereditary variations, and by the action of parasites : mosaic would seem to belong to the last named.

Malnutrition chloroses may be caused by deficiency of iron, calcium, potassium, phosphorus or nitrogen, or by an excess or deficiency of moisture. Thus maize shows chlorosis when the amount of moisture is abnormal, and most field crops show similar appearances when deprived of certain chemical elements. Several cases of this form of chlorosis were noted at Soledad in the cane fields, where some plants were apparently suffering from too little water, and others from an excess of lime. In general, the whole plant in these cases showed a starved condition, while the yellowing was uniformly diffused, thus very easily distinguishable from the other chloroses. There are a multitude of *hereditary chloroses*, familiar to everyone under the name of variegated plants. In maize between fifteen and twenty forms have been isolated and shown to be inherited, and four kinds were seen in seedlings of the sugar cane at Soledad. Five coloured plates are given with nine such chloroses in maize, each with a definite and distinct striping : these forms of chlorosis are not of course infectious, but merely characteristic of the variety. But there is one important point with regard to these hereditary chloroses of the maize. This is, that, although the deficiency in the green colouring matter of the leaf is generally far greater than in the cane mosaic, it appears to have little effect on the crop of maize produced ; in fact some cases are mentioned in which the yield is better in the variegated forms than in the parents from

which they have arisen. On this showing, the destructiveness of sugar cane mosaic cannot be put down wholly to a lack of green in the leaves.

Infectious chloroses are usually termed mosaics because the pattern on the leaf is usually in blotches rather than in stripes ; and those in the sugar cane as in other plants are readily distinguished by this character. They are diseases similar to many in human beings and animals ; but, while they behave exactly as if they are caused by some living organism, the true nature of this causal agent is at present unknown. Although mosaic diseases of crop plants have been known for a long time, they have only been carefully studied during the past thirty years ; and even then there was at first little progress because of erroneous theories as to their character. At first they were thought to be a form of hereditary chlorosis originating as a bud or sport, and when their infectiousness was established, enzymes, bacteria and protozoa in turn were held responsible for them. None of these theories proving tenable, investigators were perforce thrown back upon the idea that " mosaic diseases are true diseases caused by infectious, filterable, viruses which act like organisms of ultramicroscopic size." But, in spite of this setback, a great deal has been learnt concerning their effect on the plant, how they are spread and how they may be controlled. The infective power has been traced to the juice, which can be passed through filters capable of holding back the smallest bacteria known ; and the virus is destroyed by heat and germicides, but persists when diluted even ten thousand times.

The ease of artificial transmission varies enormously in different viruses. In tobacco, for instance, it can be spread by the mere rubbing of a finger, while in other cases it has required long and patient study. It can be spread by grafting but not through seed, excepting among the Leguminosae. In all cases sucking insects play an important part in transmission ; aphids in the potato, lettuce, bean, cabbage and spinach ; and in the latter it has been shown that the virus may be passed down to the fourth generation still unimpaired. In the melon mosaic the infection is passed during summer by aphids and also by beetles, but in the winter only through the perennial wild cucumber. This easy transmission by insects is readily explained by the fact that the virus is destroyed by drying or oxidation, from which the juice is protected while in the insect's body. And this fact has been made use of in the laboratory by pressing out the juice under oil and then inserting it by a hypodermic syringe. Recently, ELMER, using acetone, claims to have succeeded in transmitting the mosaics of the potato, bean, and cucumber indiscriminately, as if they were one and the same disease—a claim of such enormous importance that it should be verified. Lastly, " the limits of size of these organisms have been demonstrated by DUGGAR who, using a graduated series of filters, was able to determine the precise point at which the virus was unable to pass through. The interstices of the filters were measured by means of colloid particles of known size."

THE RATIONAL DISTRIBUTION OF IRRIGATION WATER PRACTISED ON EWA PLANTATION. **W. P. Alexander.** *Submitted to the 48th Annual Meeting of the Hawaiian Sugar Planters' Association, December, 1928.*

In a former number of this Journal[1] some account was given of the formation, by the Oahu Plantation Company in Hawaii, of a Department of Agricultural Research and Control. In that article the foundation of a policy of manuring the fields was briefly discussed, as showing the advantages gained by the application of scientific research to the fields. The present

[1] February, 1928, p. 69.

pamphlet contains a similar analysis of the irrigation studies and their result during the past eight years. The thesis would have been more complete for the reviewer, if a summary of the normal rainfall throughout the year had been added ; for we know that in most of the islands irrigation is applied even where the rainfall would be considered elsewhere to be sufficient to grow the crop, and this with profitable results.

The brochure is written in a semi-popular style, and deals with the practical side as follows : The cost of pumping water at Ewa, delivering it to the fields, and applying it to the sugar cane costs round about half a million dollars a year : the staff employed consists of a head irrigation officer, nine sectional overseers, 120 ditchmen, and some 500 actual irrigators ; and the first question to decide is whether this heavy expense is justified by results. Speaking from the economic standpoint, as in the former manurial discussion, here is a case of an investment of capital : what are the returns ? The conclusions arrived at by the author are that this work has "brought untold results to Ewa, if not elsewhere in the Territory : the importance of summer irrigation has received a new emphasis, and at Ewa at any rate the dividends on the outlay have kept rolling in." It is added that the whole body of the irrigation staff is enthusiastic as to the amount of water they receive, and yet a considerably less amount is actually given during the time that the plants are in the ground.

Over 2000 more acres have been irrigated per month, the average interval between irrigations has been reduced by three days, and the water has been conserved so that the depth of application is 12 per cent. less.

The great bulk of the cane grown in any year in Hawaii appears to be in the form of ratoons, and the irrigation of these is discussed in some detail from start to finish—from the moment the previous harvest is reaped to the final cutting of the cane nearly two years later. For this purpose, the life of the crop is divided up into sections : very young canes, boom period, big canes, pre-maturity, ripening off ; and it is seen that very different treatment is recommended for these different periods of growth, which of course might be expected, as in other crops, from the ecological point of view.

Obviously the practice will vary with the different soils and their moisture retaining power. A sketch map divides these into four main groups as follows : (1) General soil type, well drained, deep, black clay loam, (2) sloping fields, often very rocky, *pali* type, (3) coral type, limestone, rocky, shallow and (4) wet soil type, poorly drained. But there are multitudes of further sub-divisions among the different fields, and indeed in many individual fields ; and all of these are taken into account in deciding when and how much water to apply. In a few cases the unevenness of the fields is so great that the amount of water given has to be left to the individual irrigator, who will know from experience the "wet spots and dry spots" and treat them accordingly ; but after years of experimental trials in the response to varying treatment, the routine irrigation practice has been determined for each field, and is summarized in the form of a diagram easy to understand, of which an example is here reproduced from the 48 in the "Irrigation Manual" of the estate. In this table there are no details as to the amount of water to be led on to the land,[1] but the intervals between waterings are indicated for each month, in four normal ratoon crops started and reaped at different times. Any other factors entering in, such as rainfall, wind, soil moisture, temperature, rate of growth and so on, are discussed at regular meetings of the overseers ; and, with the manual

[1] Measuring the water is by no means neglected, but this is no concern of the actual irrigators. On 2500 acres meters are installed, and measuring stations are inserted between different sections.

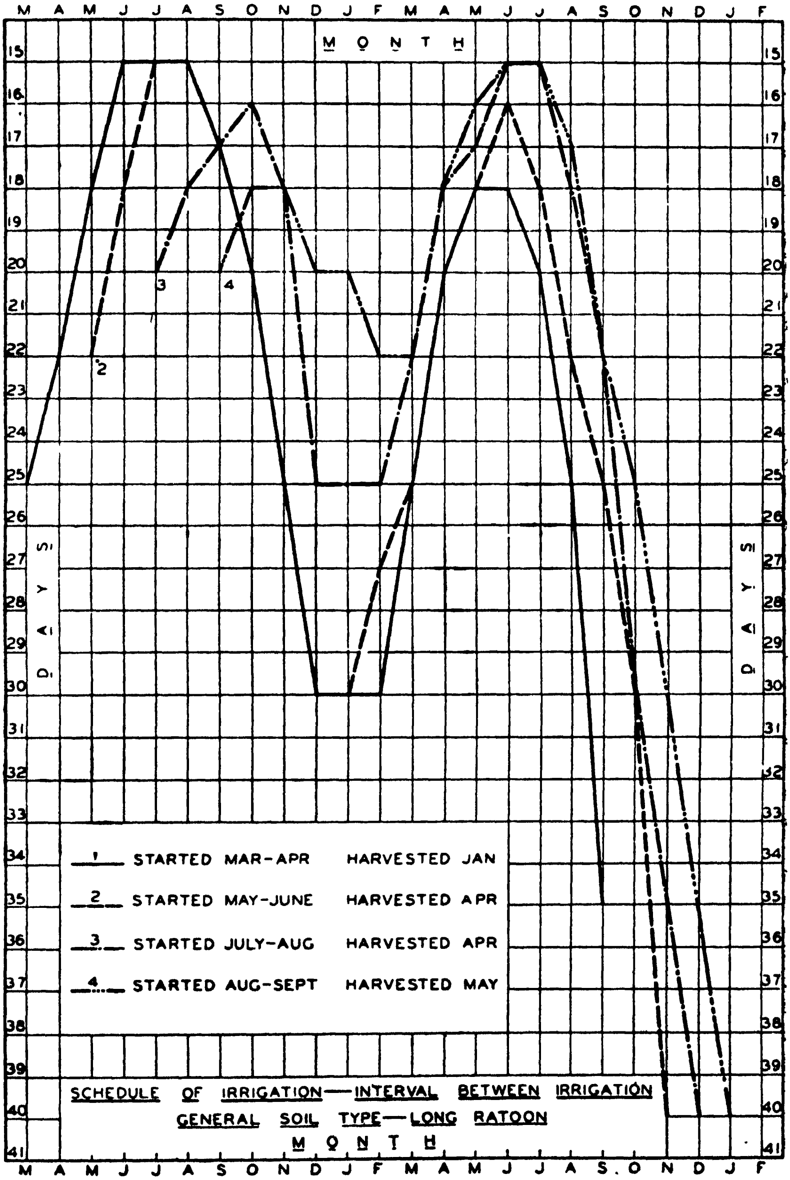
schedules as a basis, modifications are decided on which are passed down to the actual irrigators, who themselves are already quite prepared for such changes.

In order that each field can get its water at the scheduled time, swift and steady work is needed, and the progress in each field is publicly displayed on large blackboards hung outside the office. On these, by a series of markings, letters, pegs of different colours and so on, any slackness or irregularity can be seen at a glance ; and it is stated that the greatest interest is shown by the workers in these boards, and a considerable amount of emulation is evinced as to their individual records. The result of all this is concisely put by the author in the following ; " We do not wake up after the crop is reaped to discover that poor supervision in a certain field has reduced the yield." " The day of the old time Japanese irrigator is passing—this man who usually had been in the same field for many years, who knew every foot of the soil intimately, and who, realizing that he was being paid on tonnage produced, was conscientious and very careful to see that the field was handled properly. The Philipino irrigator is strong and willing, but untrained. Very often he is here to-day and there tomorrow. He cannot visualize his final settlement 20 months ahead. He needs much more supervision than the veteran irrigator, and it is found that our system of control fits his needs exactly. Times are changing and new methods are in order which will keep one's finger on the pulse, as it were, of the movements of the irrigators within the field." And the men are said to like it, and trust the system thoroughly.

The first principle insisted on is that it is absolutely essential to see that irrigation is given immediately after the canes are cut, and if necessary all other work in the fields should be suspended till this is done : a plate shows the resulting poor growth of the cane, if it is allowed, so to speak, to go to sleep. After this has been done, there is a period of very young cane, when long intervals between irrigations will give plenty of time to get the soil into good condition and attend to other routine work. Three weeks or even a month may pass before the next irrigation is needed ; and these long intervals are sufficient during 10 to 12 weeks. Then comes the " boom " stage, which lasts to about the eleventh month. Now the young canes are seen to be forming at the base of the shoots. And for the next 6-9 months the fields require more water than at any other time, and fertilizers should also be applied, because the framework of the future crop is being laid down. A diagram shows a quite remarkable jump in the curve of growth when this period begins. Then follows the " big cane " stage, from 11 to 14 months, and it is interesting to note in the photograph how the bulk of the H 109 canes are lying flat on the ground. Here irrigation is less needed, and great waste will occur if much is attempted, as is obvious from the state of the field ; increase in yield is rather in the growth of suckers than in the slight elongation of the prostrate canes.

Twelve months have been arbitrarily fixed for the commencement of the slowing down of irrigation for ripening purposes. This reduction of water should be gradual, in order to bring growth to a standstill. The effect of this slowing down of growth on the purity of the juice is shown in a remarkable curve, which illustrates the inverse relation between purity and the monthly rate of elongation of the cane, founded on over 40,000 measurements and over 8000 analyses worked out in three successive harvests. While the rate of elongation in these samples decreased from 120 to 30 inches a month, the purity increased from 76 to 90. The curve is perfectly straight, and shows a " straight line correlation." Lastly, comes the period when no irrigation is given ; and this bears a close relation to the time of harvest. From an application of the

IRRIGATION IN HAWAII.



The "Manual of Irrigation" used at Ewa contains charts similar to this one, giving the recommended interval between irrigation for each month of the year for cane growing under different soil conditions and starting at various seasons. This chart is applicable to long ratoons starting at four different periods and harvested at different times on a general soil type. There are others for coral, pali and poorly drained soils giving different intervals. In addition the same ranges covered for plant cane and short ratoons. There is a total of 48 schedules drawn up to meet a like number of conditions.

method of trial and error during eight years, this period has been fixed at Ewa as 40-80 days before harvest; and the approximate date of cutting the canes in each ratooned field is usually forecasted two or three years in advance.

The paper is well illustrated. There is a picture of a blackboard, with an added diagram showing the significance of the various signs used; and a large number of "growth curves in relation to frequency of irrigation," founded on the results of interval experiments, are placed at the end for those who may be interested.

PARASITES AND HYPER-PARASITES OF *Diatraea saccharalis* IN TUCUMAN SUGAR CANE. *Revista Industrial y Agricola de Tucuman.* Vol. XVII, *Nos.* 7-8. **Juan Brèthes.**

A translation of this paper has been kindly provided by Dr. CROSS. It consists of purely scientific descriptions of four newly discovered insects, parasitic on the common moth borer and on its parasites. There are no references to the places of occurrence, habits, distribution, or relative abundance, but the paper provides valuable data for the economic entomologist to work upon. From internal evidence, three of the insects described would appear to be parasites on Diatraea: *Microdus Crossi*, n. sp., *Ipobracon tucumanus*, Brèthes, and *Sarcophaga diatraeae* n. sp. The fourth, *Aulatopria tucumanus*, n. gen., n. sp., is parasitic on the Sarcophaga.

SCHADELIJKE WERKING VAN MELASSE IN DEN GROND. **O. Arrhenius.** *Archief voor de Suikerindustrie in Nederlandsch-Indie.* No. 31, August, 1927.

In this paper the author deals with the effect on the soil of mixing molasses with the nitrogenous manures added in the cane fields. He finds that the effect on the fertility of the soil is injurious at first, but that the soil recovers afterwards; and that the time it takes for this recovery depends primarily on the physical character of the soil: it quickly wears off in sandy soils, but persists for a much longer time in those of a clayey nature. And in tracing the reason for this injurious effect, he comes to the conclusion that it is to be found in the activities of the microflora engaged in the fermentation of the sugar contained in the molasses; in that they multiply enormously, and rapidly clear the soil of any nitrogen present, for their growth and multiplication.

In his experiments which led to this result, he discarded the sugar cane as unsuited, in that it is at first partly supplied with nutriment by the set, and also because it takes such a long time to mature, with the danger of other factors intervening. *Amaranthus tricolor*, a common "spinach" in the tropics, was selected for the study: it grows to a large size very rapidly, passing from seed to mature plant in two months; the seeds are extremely small, and with very little food for the seedling in consequence. The experiment was conducted with a sandy soil and a clayey, both provided with humus: three pots each were manured with ammonium sulphate, and with ammonium sulphate plus molasses, while three were untreated; and three additional pots were sown three weeks after the first ones, these also with ammonium sulphate and molasses. Germinations were counted daily for the first seven days in all pots: and after two months the plants were harvested, and their dry weights recorded.

Germination was distinctly retarded by the addition of molasses, and the growth of the plants was hindered; but these effects were much more lasting in the clayey soil. In the sandy soil a remarkable change in growth took place during the third week, when suddenly the molasses plants began to grow rapidly, and in a couple of days overtook the rest. The ultimate dry weights of 50 plants were: untreated 0·84 grms., ammonium sulphate alone 2·61 grms., with molasses 5·63 grms., and in the late sown pots 6·23 grms. In the clayey soil not only was the germination delayed, but the comparative dry weights

in the different treatments were very different. Taking the treatments in the same order, the dry weights of 50 mature plants were 3·5 grms., 8·1 grms., 4·0 grms., and 4·2 grms., respectively. These results are taken as showing that the injurious effects of the molasses were still at work in the clay soil after two months.

In order to prove that these effects of adding molasses to the soils were due to the lack of nitrogen owing to the hunger of the microflora engaged in fermentation of the sugar, ARRHENIUS conducted a separate experiment with the same soils in the laboratory, treating them in a similar manner, but using *various* quantities of ammonium sulphate and of molasses in the same way as before. At intervals after adding the manures, he determined the amount of NO_3 present in each case, in mg. per kg. of dry soil. He treated the pots with different quantities of molasses alone, ammonium sulphate alone, and different quantities of sulphate with molasses, with untreated pots as controls. The sandy soils were examined at three and at four weeks, and the clayey at the end of one and of two months. The results of this experiment were much the same as those conducted with the living plants, if one were to regard the extent of fertility as correlated with the amount of nitrogen available.

C.A.B.

Second Cuban Technical Conference.[1]

CENTRIFUGALS AND THEIR OPERATION.

C. L. AMAN pointed out that the belt-driven centrifugal, in spite of the larger number of moving parts and the resulting higher upkeep, has been the most popular kind in recent years, compared with electrical or hydraulic machines. It has been so improved that larger capacities are secured ; its initial cost is considerably lower ; and it has now been designed to operate successfully on the 1½-minute cycle.

Low-grade sugar, of course, requires greater centrifugal force for proper purging than does a higher quality. Low-grade massecuite should be cooled immediately to 80°F. to reduce the final purity of its molasses ; but it can be re-heated to 135°F. without dissolving any sucrose, at which temperature the viscosity will be lower. High grade massecuite is usually dropped direct from the pan at about 140°F., at which temperature it purges rapidly.

Acceleration to the full speed of 1100 revs. per min. is accomplished in various types of machines from 30 secs. upwards ; running at full speed with free-purging high-grade sugar should not take more than 10 secs., but with low-grade with high molasses viscosity it may be from 10 to 15 mins. Braking may require from 10 to 60 secs. ; unloading of first-grade by hand takes 30 to 45 secs., and on low-grade from 1 to 10 min. By the use of mechanical unloaders low-grade sugar can be unloaded in 15 to 25 secs. with first grades, and from 25 secs. to 3 min. with low-grades.

Self-discharging baskets have not been accepted as a proper design for raw sugar work. Machines thus fitted must come to a dead stop before the sugar will drop, time thus being lost in acceleration. Moreover, the screens must be scraped clean by hand every 5 or 6 charges, otherwise they become clogged to an extent sufficient to reduce the rate of purging of succeeding charges. The extra cost of the self-discharging baskets over the standard basket is usually twice the cost of the mechanical unloader. The former has a greater cubic content than the standard basket, and it is possible that a specially designed unloader could be fitted to the self-discharging type of

[1] Abstracted from *Proceedings of the Second Annual Conference of the Cuban Sugar Technologists*, 1928.

basket with advantage. In some cases completely filling the basket will increase the centrifugal production at least 50 per cent.

Opinion as to the use of perforated screens for baskets is about equally divided between the conical slot and the round hole perforations. The former are usually the more expensive, but have a filtering area of 22 per cent., while the usual 400 holes per sq. in. with a 0·023 in. diam. perforation has one of 16·6 per cent. The conical slot has a narrower opening, which prevents to a larger extent the loss of the fine grains. A backing screen of 8-mesh is used generally, but it often gets clogged with highly viscous molasses, particularly when the perforations in the side sheets of the baskets are small and widely spaced. By increasing the size and number of holes in the side sheets of the basket, and by using a secondary heavy backing screen, or a heavy perforated plate with conical holes, greater facility is given for the discharge of the molasses.

BALING BAGASSE FOR DEAD-SEASON FUEL.

J. P. PERCY, dealing with the question of the disposal of a surplus of bagasse, stated that, rather than burn this away in a special furnace to get rid of it, a better solution is to bale it and store it for use during the dead season to replace the usual fuel used at that time. Or one may sell to some company utilizing the bagasse for commercial purposes. There are numerous presses on the market suitable for this baling, the most suitable being of the plunger type, operating at 15 strokes per min., making a bale of 18 in. × 22 in. × 30 in. with two wire ties, the weight being approximately 225 lbs. of material containing 50 per cent. of water. One block man, feeder, and two wire men can turn out 75 bales per hour.

When using bagasse for commercial purposes, it is necessary to pile in an open stack or checkers board, leaving space between the bales for ventilation to avoid discoloration and decomposition. But in piling for the dead-season fuel, it is preferable to pile the bales as close together as possible, filling in between with loose bagasse broken from the bales while handling. This latter method reduces the fire risk, due to the smaller exposed surface, and also reduces the storage space and the cost of handling. Anyway, the hazard of fire is apparently small, as bagasse has been stacked in 10,000-bale piles 14 bales high, using the method of filling in between the bales just mentioned, and allowed to stand for periods of three to six months. Decomposition had taken place in the centre of the piles, decreasing the fuel value approximately 5 to 10 per cent. After storage for three months, the average decrease in the weight of the bales was found to be about 45 per cent.

To reduce the cost of baling, an attempt was made to burn the bales intact in a double horse-shoe furnace, serving a B. &. W. boiler of 965 H.P., where it was necessary to maintain a rating of 60 per cent. It was found necessary, however, to break the bales into quarters in order to hold this rating, which could be increased yet further by finer division. Indications were obtained that the unit could be operated efficiently and economically at full rating by breaking the bales up with a mechanical shredder, feeding the furnace in the same way as during the crop. Considering 1 ton of dry fibre, or approximately two tons of bagasse leaving the mills, equivalent to 2,345 barrels of fuel oil, which has proved to be a conservative figure, there is a decided advantage in using baled bagasse for dead-season fuel in place of fuel oil at its present price.

OBSERVATIONS ON LUBRICATION,

JERÓNIMO DÍAZ-COMPAIN, in dealing with the storing and distributing of lubricants, mentioned the importance of employing an intelligent man for this work. He should send out material every six hours during the crop,

and a table should be prepared showing the quantity assigned to each engine or department. At the beginning a little more oil than is estimated necessary should be assigned, and this amount reduced from week to week in accordance with observations made of the surfaces of the bearings until the minimum is established.

Different automatic methods of continuous lubrication entail a certain capital outlay, but are a good investment. Without considering these, the immediate steps to obtain efficiency and economy in lubrication are : (*a*) total elimination of oil-can lubrication, as this means intermittent lubrication with injury to the bearings and waste of oil ; (*b*) the installation of " drop counting oil-cups " and grease cups ; and (*c*) the teaching of the man-in-charge the proper lubrication requirements for the different parts of the machinery, so that the number of drops per minute from each cup be in proportion to the surface of contact of the bearing. Usually the "greaser" is a labourer only generally ill-paid, whose title is almost always treated with contempt. Yet if he were an experienced man he could save many times his wages.

One of the most important factors in the efficiency of the bearings is the oil grooves, which are an unnecessary evil, and as few should be cut as possible. Too many of them reduce to a serious extent the surface of contact of the bearings, and they may be placed in such a way that they permit the lubricants to flow off the bearings without having effected efficient lubrication. When improperly located, the tendency is to break the lubricating film between the surfaces in frictional contact.

With a view to distributing the lubricant with the least difficulty and waste over all the bearings, it is advisable that the channel of supply should enter the groove at its longitudinal centre. In order that the grooves and the deposits formed by the chambers between bearings be effective, all edges must be rounded so that the lubricant can get between the surfaces in contact. If these edges are left unrounded they will scrape off the film of lubricant which adheres to the surface of the shaft where the said shaft comes into contact with the groove and the deposits.

When proper methods of recovery are put into practice many of the oils can be utilized again in secondary places. They should be left to stand a sufficient time to allow all impurities and sediments to precipitate, filtering them again before re-use. Oils thus recovered (e.g., those that drop from bearings) should be almost enough for lubricating the following equipment : basculator, chains of cane carriers and all its idler shafts, chains of the bagasse carrier, shaft, bagasse bins and ventilators ; filter-presses, machines for washing press-cloths, wheel barrows and small cars in the sugar warehouse, etc. Other oils that may be recovered are those used in the cylinders of the engines, and after being cleaned and mixed with other greases they may be used for : all gears of the milling plant, cane elevators, crystallizers, and to preserve materials from rust exposed to the weather. A certain Central, far from being up to date, was able by close attention to such details to increase the general efficiency, and reduce the cost of repairs, and also to lower the consumption of lubricants from \$0·02 to \$0·008 per 100 arrobas of cane.

Value of Crystallizers.

Claassen's conclusions, announced since 1897, against crystallization in motion are decisive, stated Juan G. Salinas, and nobody has been able satisfactorily to refute his opinions, which may be summed up in his definition of crystallizers as " bad vacuum pans." He went on to say that in his experiments it was possible to prove that during the cooling of the massecuite in

the crystallizer there is a proportional increase of the glucose. This increase can be attributed to the inversion of sucrose produced by "frothy fermentation" the causes of which have not yet been fully determined. It is in direct proportion to the *pH* value of the syrup and molasses used.

In fact the effect of crystallization is slow inversion. One gains sucrose as a consequence of the partial desaccharification of the mother-syrup or enveloping molasses; but on the other hand one loses part by the direct action of the fermentation and by the indirect action due to the increase of the viscosity on cooling. Nowadays the idea is to make the cooling process as rapid as possible; and we believe that to the vacuum pan, not to the crystallizer, should be ascribed the work of exhaustion, using a continuous circulation of water through the calandria, assisted by the mechanical movement of the massecuite, as in the case of the Freytag pan, while always bearing in mind the factor of the supersaturation of the mother-molasses at the beginning of the cooling.

In the first series of experiments, three massecuites (*A*, *B*, and *C*) were treated with prolonged cooling (48 hours in the cases of *A* and *B*, and 120 hours in that of *C*) in crystallizers of the ordinary type, determining the temperature fall (66 to about 30°C.), the *pH* value (6·9 to 7·0 initially, falling to 6·2) and the Brix (93·2 to 95·4 for *A*, 93·7 to 95·6 for *B*, and 94·1 to 96·0 for *C*), as well as the purity and the glucose contents. In regard to the purity fall, this was 78·8 to 76·00 for *A*, 71·2 to 66·6 for *B*, and 60·4 to 54·4 for *C*; while the increase of glucose per cent. was 5·8 to 8·6 for *A*, 6·9 to 9·3 for *B*, and 12·0 to 17·9 for *C*.

As to the second series of experiments, these were made with three massecuites, *A*, *B*, and *C*, cooling in the pan, each being finished with sustained vacuum and without circulation of water in the calandria, the same values being determined. *A* and *B* massecuites were both treated four hours, and *C* for five hours. Temperature fall was 67 to 42° for *A*, 66 to 47° for *B*, and 68 to 44° for *C*. The Brix increase was from 93·5 to 94·7 for *A*, 94·2 to 95·0 for *B*, and 94·0 to 95·0° for *C*. The *pH* was practically stationary at 6·9 to 7·0. The purity altered little in the time stated, being initially and finally 80·0 and 79·8 for *A*, 71·9 and 72·0 for *B*, and 58·5 to 58·3 for *C*. Nor did the glucose per cent. alter much, being 5·5 to 5·35 for *A*, 7·8 to 7·9 for *B*, and 15·2 to 15·4 for *C*.

These figures show the pronounced inversion which took place during the cooling in crystallizers, the extraordinary lowering of the *pH* values, and the gradual increase of the glucose content in the three massecuites. In the *C* strike the viscosity was so pronounced that the increase of time required for its drying was marked. In the *A* and *B* strikes, though an increase in the size of the crystals was observed, this was very unfavourably counterbalanced by the greater amount of water added for purging.

But in the second series of experiments, all three strikes were purged immediately on being discharged from the pan with an incomparably superior result to that obtained in the first series. No water was needed for purging, even in the case of *C* massecuite, which was done rapidly leaving the sugar in uniform state. The purity of the molasses produced in each case does not differ extraordinarily, taking into consideration the time taken in cooling in each case. The subject merits the attention of all sugar experts in a position to make a series of strictly conducted experiments. The author of this paper is ready and eager to exchange ideas on the subject.

Rapid Method for the Determination of Phosphoric Acid in Sugar Factory and Refinery Products.

By R. G. W. FARNELL, A.I.C., A.R.C.S.

The important rôle played by phosphates in clarification is gradually becoming recognized.[1] For satisfactory defecation by lime and heat the P_2O_5 content of mixed juice should be about 0·03 per cent. or over, and actually in Natal where the juice colloids are high and the soil deficient in phosphates, the P_2O_5 content is sometimes raised as high as 0·05 to 0·06 per cent., the resulting clarification being beneficially affected. The actual addition of phosphoric acid varies there from 1 lb. to 18 lbs. of commercial phosphate (38 per cent. P_2O_5) per ton of sugar.

In order to ensure satisfactory clarification and free filtering sugars, it is obviously desirable to determine the P_2O_5 naturally occurring in the juice and to correct accordingly; practically all the phosphate is precipitated eventually as tricalcium phosphate providing the *pH* be raised to 7 or over. A quick and simple method, accurate to 5 per cent., enabling a P_2O_5 analysis to be completed in a few minutes, should appeal to sugar-house chemists, who generally have their time too fully occupied with routine work to investigate special tests. The method once tried out should feature in the regular analyses, giving results of great value in controlling the all-important stage of clarification.

I am indebted to Mr. H. B. SPRINGER, Research Chemist, Blairmont Factory, British Guiana, who first showed me this method of phosphoric determination, which is now standard practice at the above factory, and also at the Illovo Sugar Estates, Natal.

The coeruleo-molybdate method of phosphate analysis, first described by ATKINS,[2] depends on the formation of a blue colour caused by the addition of acidified ammonium molybdate to a very dilute phosphate solution, followed by a few drops of stannous chloride.

REAGENTS AND APPARATUS.

The following solutions are required :—(I) 25 grms. ammonium molybdate dissolved in 250 c.c. water, to which is slowly added 750 c.c. of H_2SO_4 50 per cent. by volume. This solution should be kept in a dark bottle, preferably paraffined, in order to reduce silica contamination. (II) 0·1 grm. pure tin, dissolved by warming in 10 c.c. concentrated HCl, to which is added 1 drop of a 4 per cent. solution of $CuSO_4$. The solution should be made up in a test tube fitted with rubber cork and dropping tube, and should be prepared frequently, i.e , every other day.

The standard phosphate solutions are prepared as follows :—(*A*) 1·34 grms. trisodium phosphate ($Na_3PO_4 . 12H_2O$) in 250 c.c. water, this solution containing 1 mgm. of P_2O_5 per c.c. (*B*) 10 c.c. of solution *A* diluted to 1000 c.c., this containing 1/100 mgm. P_2O_5 per c.c. (*C*) 10 c.c. of solution *B* diluted to 500 c.c., this containing 1/5000 mgm. P_2O_5 per c.c.

Besides the ordinary volumetric flasks (250 c.c., 500 c.c., and 1000 c.c.) there are required 1 c.c., 2 c.c., 10 c.c. and 50 c.c. pipettes, and 2 Hehner tubes (100 c.c.). If the latter are not obtainable, 2 Nessler tubes (100 c.c.) will suffice, together with a 100 c.c. graduated cylinder. In addition there are required white tiles for facilitating the comparison of the colours, and also glass stirring rods for mixing the solutions in the tubes.

---

1 MCALLEP and BOMONTI : *Hawaiian Planters' Record*, 1922, 26, 122. BOND : *Ind. Eng. Chem.*, 1925, 17, 492. FARNELL : *J.S.C.I.*, 1926, 45, 343T. SCHWEIZER, *Archief*, 1927, 35, No. 5, 149.

2 *J. Agr. Sci.*, 1924, 14, 192.

METHOD.

Measure 98 c.c. of phosphate solution *C* into one of the tubes (if a Nessler tube, make up to the 100 mark and then pipette out 2 c.c.). To the other tube, add 98 c.c. of the dilute sugar solution in question; to each tube add 2 c.c. of solution *I*, followed by 5 drops of solution *II*. The contents of both tubes are stirred with glass rods and the blue colour develops. In five minutes the maximum coloration will have been formed and a comparison can be made. Assume that the colour developed in the unknown solution (a 0·2 per cent. solution of mixed juice, 1 c.c. juice diluted to 500 c.c.) is greater than that of the standard phosphate. A certain portion of the unknown solution is run off from the Hehner tube, (or poured out from the Nessler tube into a measuring cylinder) until the intensity of colour in the unknown is only very slightly greater than the standard phosphate.

The volume remaining in the Hehner or Nessler tube is read and we will assume it is 83 c.c. Water is added up to the 100 mark, and the solution stirred. Still being too dark, 5 c.c. more are run off and the depth of colour in the unknown is now equal to that in the standard phosphate solution. (If desired water can again be added to the unknown to make the volume exactly 100 c.c. so that identical depths of solution are being compared.) The volume of the original sugar solution remaining in the tube is therefore $\frac{85 \times 95}{100} = 81$ c.c. approximately. This represents $\frac{81}{500}$ c.c. of the original mixed juice, which contains the same amount of phosphate as the standard, i.e., 1/50 mgm.; 100 c.c. of mixed juice will therefore contain $\frac{500 \times 100}{81 \times 50 \times 1000}$ $= 0{\cdot}012$ grm. P_2O_5, or approximately 0·012 per cent.

For mixed juice the dilution is 1 c.c. to 500 c.c.; compare with phosphate *C*; for clarified juice 10 c.c. to 500 c.c.; for affined sugar melt 25 c.c. to 500 c.c.; and for char filtered liquor 50 c.c. to 500 c.c. For raw 96° sugar and for final molasses the opalescence generally necessitates a preliminary kieselguhr filtration. 5 grms. of the raw sugar are dissolved in water and made up to 100 c.c.; 10 grms. of "Filter-cel" are added, and 50 c.c. of the filtrate are diluted in the Hehner tube to 98 c.c. and examined as usual. For final molasses 1 grm. is made up to 1000 c.c., and 100 c.c. of the dilute solution are clarified with "Filter-cel," 50 c.c. of the filtrate being diluted in the Hehner tube to 98 c.c. Ordinary tap water may be used for dilution purposes. The standard colour given by 100 c.c. of phosphate solution *C* lasts about two hours, after which it fades somewhat and must be made up afresh.

RESULTS.

Average results (extending over three months) of phosphate analyses performed at the Illovo Sugar Estates, Natal, on 24 hourly composite samples are tabulated below, and refer both to the raw sugar factory and also to the refinery ("Suchar" Process.[1]).

It will be observed that 97·1 per cent. of the P_2O_5 in the treated juice is precipitated as tricalcium phosphate during the clarification and settling in tanks, whence it leaves at *pH* 7. Hot sulphuring is employed at Illovo, a practice now almost universal throughout Natal. In this process the raw juice is first heated to 140-150°F., the greater part of the lime added, and the juice is then sulphured, after which a small amount of lime is again added in order to correct the *pH* to about 7·6, the juice being finally heated to 210-215°

[1] I am indebted to the Directors of the Illovo Sugar Estates for leave to publish these figures.

F. and settled. The phosphoric acid can either be added to the raw juice prior to sulphuring, or to the sulphured juice prior to the final heating, there seeming to be little to choose between either practice. It is essential in Natal, however, to add the P_2O_5 to the juice before it is raised to the final temperature round the boiling point, as otherwise settling is delayed in the clarifiers.

If the sulphuring of the juice is conducted in the cold the precipitation of phosphate is not so complete. For many reasons hot sulphuring appears to effect a better removal of the colloidal impurities than the cold operation, principally owing to the coagulation of the albuminoids, whose isoelectric point approximates to the natural *pH* of the juice, and also owing to the more complete precipitation of the colloid-entraining substances, calcium sulphite, and calcium phosphate.[1]

In the refinery it will be noticed that 87 per cent. of the P_2O_5 naturally occuring in the melt is removed on filtration through "Suchar" carbon. It is well known that decolorizing carbons preferentially adsorb phosphates, and also certain kations such as Ca and Fe. The addition of the mildly alkaline trisodium phosphate to melted sugar has been recommended by BARDORF,[2] in order to trap cane wax Moreover trisodium phosphate being an excellent buffer should tend to stabilize the *pH* of the liquors.

Finally it is interesting to note that experience at Illovo showed that application of phosphatic fertilizers to the soil tended to increase the P_2O_5 in the mixed juice of the cane grown on that soil, and recently DODDS, FOWLIE, and MCRAE[3] have shown conclusively that the P_2O_5 content of Uba cane juice was increased from 0·0064 per cent. (control) up to a maximum of 0·0177 per cent. by application of basic slag, while superphosphate, rock phosphate, bone dust, and Rhoen. phosphate all increased the P_2O_5 content of the cane juice, besides of course being responsible for an increased yield of cane to the acre.

TABLE OF RESULTS.

Mixed juice (P_2O_5 grms. per 100 c.c.)		*Treated juice* (after addition of P_2O_5)	
maximum	0·040	maximum	0·063
minimum	0·006	minimum	0·010
average	0·0165	average	0·028 (N.B. This is now being increased)
Clarified juice.		P_2O_5 precipitated per cent. P_2O_5 *in treated juice.*	
maximum	0·0017	maximum	98·9 per cent.
minimum	0·0004	minimum	94·8 per cent.
average	0·0008	average	97·1 per cent.

Raw 96° sugar average, 0·0024 P_2O_5 per cent.; refinery melt average, 0·00100 per cent. P_2O_5 (Brix); filtered liquor ("Suchar') 0·00013 per cent.; P_2O_5 precipitated and adsorbed per cent. P_2O_5 in refinery melt, 87 per cent.

YIELDS IN HAWAII.—Alexander & Baldwin factories in Hawaii for the 1928 crop gave some high yields; Kahuku headed the list with 71·29 tons cane per acre; Puunene had 9·75 tons of sugar per acre and an average polarization of 97·95. In the case of plant cane alone, Maui topped the list with 92·68 tons cane per acre and 12·64 tons sugar.

ABSOLUTE ALCOHOL.—Processes of the firm of Merck, Darmstadt, Germany, for the industrial production of absolute alcohol, already being worked extensively, are now to be introduced in England. Solvent Products, Ltd., are reported to be erecting a plant under licence at Dagenham.

---

1 FARNELL, *J.C.S.I.*, 1925, 44, 530T. 2 *Ind. Eng. Chem.*, 1928, 20, 258.
3 Advance copy of Report of the Natal Sugar Experiment Station on "Some Field Experiments with Fertilizers for Sugar Cane."

British Beet Sugar.

Types of Sugar Beet Seed.

This month we have before us the "Report and Summary of the Results of Experiments" of the Agricultural Institute, Kirton, where some very useful work on this suitability of different types of beet seed, and on the manuring of the crop, has been carried out. Although this Report does not cover all the work to date of the Institute, it contains some material which we have not reproduced from previous summaries.[1]

Regarding the seed trials, the results obtained in 1925, 1926, and 1927 have generally been remarkably consistent, and show the superiority or inferiority of different types of beets, rather than any particular strain. Considerable variation has been found in the "bolting" propensity, which is frequently caused by a check to the young growing plant, but is also an inherent factor in the stock. Those from Poland have consistently thrown a large number of "bolters"; and the French have also produced a fairly high percentage. German stocks have generally been passable; while Dutch stocks have been remarkably free from this defect, even when sown at an early date. Swedish types have shown up well also in this respect.

As to the sugar content, the variation has not been great, and it is not possible yet to say that any particular stock will produce more sugar than another. It is, however, noticeable that the "sugar stocks," i.e., those bred for a high sugar content, have invariably shewn a higher sugar content than the "yield stocks" produced by the same firms. So far as the farmer in the County of Holland (Lincs.) is concerned, there does not appear to be any advantage in growing a "high sugar" stock, as, although these sugar stocks produce much sugar, they do not yield as much weight in roots as the "yield" or "normal" stocks. The French stocks have generally been rather low in sugar percentage.

Spacing, Manuring, Etc.

Coming now to widths in drilling and singling, Continental practice generally favours close spacing. In Germany it is usually 16 in. × 10 in., but one large farmer in Holland favours 12 in. × 11 in., obtaining an average yield of 20 tons per acre over 500 acres. In Czecho-Slovakia, 16 in. × 10 in. appears to be the best. As the result of experiments carried out by the Institute in Lincolnshire, a spacing of not more than 16 in. × 10 in. is recommended. Lastly, in regard to the manuring of sugar beet, it is advised that artificial manure may be dispensed with on all land in good heart. Where necessary, the following mixture is recommended: 1½-2 cwt. Nitrate of Soda. applied before seeding, along with 2 cwt. Superphosphate and 1-1½ cwt. Muriate of Potash. The Nitrate of Soda may be mixed with the Superphosphate and Muriate of Potash provided the mixture is sown immediately. If left for some days, the mixture will become wet and sticky. No top dressing need be applied on the average land in this district. New land is distinctly unsuited to sugar beet.

Value of Dried Beet Pulp as Fodder.

Under this heading may be considered the utilization of sugar beet pulp. Dr. H. E. Woodman continues his "Notes" on this subject,[2] pointing out that in respect of the digestibility of its total organic matter and its carbohydrate constituent, it compares very favourably with maize meal.[3] Drying in the factory does not in any way depress its value in this direction. Further it is immaterial whether the dried pulp is included in the rations of ruminants in

[1] *I.S.J.*, 1927, 93; 1928, 193.
[2] *J. Ministry Agric.* 1928, 35, 878, 978.
[3] See also *I.S.J.*, 1928, 593.

the dry or soaked condition. Although the dried material contains as much as 18 per cent. of crude fibre, this constituent is very little inferior in respect of digestibility to the carbohydrate ingredient, a fact which justifies the conclusion that the fibre in this feeding stuff is present almost wholly in the form of simple cellulose, unmixed with any significant amount of the indigestible ligno-cellulose.

Actually beet pulp contains only about 2·6 per cent. of sugar, the main carbohydrate present being pectose, which probably is rendered available for absorption into the bloodstream by the digestive action of bacteria. As to the fibre, its cellulose component is transformed mainly into glucose by the controlled activity of cellulose-splitting bacteria in the rumen, four-fifths of the dry matter of sugar beet pulp, therefore, being digested, not by the normal enzymatic processes, but by the agency of bacteria. In view of this circumstance, it is of importance to emphasize the statement that the results of the Cambridge trials in respect of the digestibility and nutritive value of sugar beet pulp are only applicable to ruminant animals. The extent to which swine are able to digest and utilize it is now being submitted to investigation.

An interesting parallel has already been shown to exist between dried sugar beet pulp and maize meal in respect of the digestion coefficients of the total organic matter and of the carbohydrate of these carbohydrate-rich foods. It appears justifiable to conclude that *dried sugar beet pulp must be included with feeding stuffs like maize meal in the class known as carbohydrate concentrates.* 100 parts of the dry matter of maize contain 89·6 parts of digestible organic matter including 77 parts of digestible total carbohydrate (i.e., digestible carbohydrate and digestible fibre); the corresponding values for sugar beet pulp are 84 and 78. With both feeding stuffs, a very large proportion of the digestible organic matter consists of digestible carbohydrate. It would thus be necessary in practice to supplement both sugar beet pulp and maize with feeding stuffs which are richer in protein. Further, both these carbohydrate foods have the characteristic of being deficient in respect of minerals. For the purpose of fattening ruminant animals, 1 lb. of dried sugar beet pulp (moisture content = 10 per cent.) may replace 0·8 lb. of maize (moisture content = 13 per cent.). In the Scandinavian system of food values, one food unit is contained in 1·2 kg. of dried sugar beet pulp and in 0·95 kg. of maize, and this means that 1 kg. of dried beet pulp is regarded as being interchangeable with 0·8 kg. of maize—a striking confirmation of the result arrived at in the Cambridge investigation, especially as the Scandinavian result represents the conclusion drawn from an essentially different line of inquiry, namely, large-scale practical feeding tests on the farm instead of digestion trials conducted under laboratory conditions.

In order to collect the opinions of practical men on the uses and feeding value of beet pulp, a circular embodying a series of questions was sent out to a number of well-known farmers. Not many replies were received, but those which came to hand were sufficient to show that this material bids fair to become a popular feeding stuff in the near future.

Dominican Republic.—Unusual conditions of drought in the southern portion of the island acted adversely upon the sugar crop in 1927, says a Consular Report, and the effect is still being felt in 1928. The total production of raw sugar in 1927 was 315,470 metric tons. The approximate average price obtained was \$2·80, an advance of 65 cents over 1926 prices. Sugar production is chiefly in the hands of American corporations, and is the most important industry in the country.

Beet Factory Technical Notes.

Pressure Evaporation.—Regarding the criticism made by PROCHAZKA as to the value of pressure evaporation in white sugar manufacture,[1] FR. TUREK and K. SAZAVSKY contribute a vigorous reply.[2] First, referring to the question of fuel economy, they quote the opinion of Prof. LINSBAUER,[3] who stated that "pressure evaporation is not a mode of the moment . . it is a matter of national economy, a most significant solution of the problem of the practical utilization of fuel in sugar manufacture." They strengthen this statement by pointing out that in the Doloplazy factory, Moravia, Czecho-Slovakia, in the contract for the supply of a Vincik-Turek pressure evaporator a guarantee of a steam consumption of 48 kg. per 100 kg. of roots, or 6 per cent. of coal, was made. Actually the results of the tests with this plant made by the officials of a boiler-testing organization were : steam consumption per 100 kg. of roots, 40·9 kg. ; consumption of coal, 4·83 ; minimum heating power of the coal, 6562 calories ; and nett evaporating power 8·473.

Thus the steam economy claimed was not only realized, but was exceeded. Second, as to the alleged colouring of the juices during evaporation, these authors bear out the view of Mr. K. VESELY, the Manager of Wissington factory,[4] namely that the bad results obtained at Oroska were due probably to the construction of the evaporator, and also to the treatment of the juices. They point out that the results obtained at Oroska were with an evaporator other than the Vincik-Turek-Sazavsky, the suitability of which for white crystal manufacture has been established. Yet another contributor to the discussion was Jar. Tietz,[5] whose special points were that the evaporating surface per ton of roots must be correctly proportioned ; that the useless juice space must be reduced to a minimum ; that the juice vapours must be properly taken off ; and further that the juice must pass very quickly through the evaporator. When these conditions are fulfilled, very satisfactory syrups are obtained, and much coal is saved. The final article is by Prochazka,[6] the inciter of the discussion, who in face of such overwhelming evidence admits the reliability of pressure evaporation, his experience to the contrary having been due to unfavourable conditions in his factory.

Pulp-Molasses Briquettes.—At Peterborough factory experiments are being made in the drying of sliced potatoes for livestock feeding, also in desiccating a mixture of the same material with beet pulp, this as a means of utilizing plant during the inter-campaign. In connexion with such matters, one notes that at the Nogent-sous-Coucy *sucrerie*, in Aisne, France, three parts of beet pulp, containing say 8 per cent. of water, and one part of molasses with about 16 per cent. of water are compressed into briquettes with rounded corners, these measuring 30 cm. ($11\frac{7}{8}$ in.) × 22 cm. ($8\frac{3}{4}$ in.) × 10 cm. (4 in.), and weighing $4\frac{1}{2}$ to $5\frac{1}{2}$ kg. (10 to 12 lbs.). The two ingredients are mixed together at ordinary temperatures, the molasses serving as binder, giving, it is said, a very hard material which can be thrown about on the floor without breaking or chipping.

Such briquettes are claimed to offer several advantages for ready transport. No packing is required, they can be piled into the smallest possible space without voids, they keep well on storage, they can be easily handled, and on placing them in water they disintegrate very readily, each briquette representing a definite amount of ration for the animals. A description of the plant at Nogent is given by Mr. ED. SAILLARD,[7] this turning out 15 briquettes

[1] *I.S.J.*, 1929, 36. [2] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 53, No. 19, 206-209. [3] *Cukrovarnicky Kalendar*, 1928 248. [4] *I.S.J.*, 1929, 89. [5] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 53, No. 19, 201-204. [6] *Ibid.*, 209-210. [7] *Suppl. Circ. hebd.*, No. 2081 of 1929.

per minute, that is about 21,600 per day of 24 hours. In a 30-ton truck from 25 to 30 tons of these briquettes can be packed, whereas in the same space it would be difficult to pack 10 tons of ordinary dry pulp. This appears an interesting idea, the first point to be examined being the keeping qualities of the briquettes, especially during transport in damp weather, particularly in this country. It would seem a matter worth examination by our beet factories.

Magnesia Clarifier.—In this paper a Russian chemist, W. J. KUSNETZOW, discusses a process of clarification, which, he suggests, may be of service, not so much for ordinary raw beet juices, but especially for the syrup obtained in the beet dehydration process, where, due to the high density, ordinary carbonatation is precluded. It consists in the use of magnesium sulphate (Epsom sa ts) as a substitute for CO_2 in precipitating the lime added. Thus: $C_{12}H_{22}O_{11}CaO + MgSO_4 + H_2O = C_{12}O_{22}O_{11} + Mg(OH)_2 + CaSO_4$, in which equation 56 parts of lime corresponding to 120·4 parts of anhydrous magnesium sulphate or to 246·4 parts of the crystalline salt. It is seen that magnesium hydroxide, known to have a good clarifying action, is thrown out of solution, and also that calcium sulphate (or gypsum) is also formed and probably partly precipitated. This method of working has been examined at the Kharkov Technical Institute, where beet raw juice was treated with about 0·75 per cent. of lime of the roots, 1·75 per cent. of ordinary chalk added, and later the magnesium sulphate run in.

The procedure is stated to have given results which are described as "not inferior" to those of ordinary double carbonatation, using 2 per cent. of lime. Light coloured juices were obtained. While the process may be of some interest for the clarification of syrup, in which the calcium sulphate formed is less likely to remain in solution, the matter is different when it is applied to raw juices of ordinary density. Such juices would hold a good amount, comparatively speaking, of calcium sulphate in solution, and this would almost be sure to cause some trouble in incrustation. In addition there is the matter of the cost of the magnesium sulphate as compared with ordinary working when the CO_2 is (so to speak) obtained for nothing from the kilns.[1] However, as an adjunct to CO_2 when dealing with juices that are unusually difficult to work, the method is well worth a trial.

Chlorine for Effluents.—In a certain beet factory in Germany experiments were made by the I. G. Farbenindustrie on the value of chlorine for the disinfection of foul-smelling effluents.[2] All the waste waters from the flumes, washers, diffusers, and pulp presses were sent into three great clarifying basins, after which the major part of it was used again in the flumes, while the rest went over irrigation fields. Samples were taken from: I, the main flume; II, the third clarifying basin; and III, the outflow from the drainage system; and each was examined for clarity, odour, reaction, *pH*, oxygen absorption, chlorine number, residue on ignition, free oxygen, sulphuretted hydrogen, and micro-organisms per c.c. It was concluded from these observations that the effluent in the main flume contained principally substances of a mineral nature (clay, loam, and sand), which were reduced to about 1/20 of their original amount by settling in the clarifying basins. But the separation of organic matter was far less complete, as all the samples taken were septic, giving rise soon to putrefactive fermentation.

Therefore, from each of the three waters, six portions were treated with gradually increasing amounts of chlorine, viz., from 0 to 64 mgrms. per litre,

1 *Centralblatt für die Zuckerindustrie*. 1929, 37, No. 6, 155.
2 *Centralblatt für die Zuckerindustrie*, 1929, 37, No. 7, 189.

being subsequently examined as to putrefactive power. It was found that the chlorine caused the unpleasant smell to disappear, and arrested the tendency to undergo fermentation, at least for a time. But in order to obtain a persistent preservative effect, or one reasonably so, an excess of chlorine was necessary, namely about 25 grms. per cub. metre which amount was capable of preserving the water for about 14 days, or a proportionately less amount would suffice if the water were returned to the main flume in a shorter time. This work is certainly interesting, though it only bears out research which has lately been done by others on the value of chlorine in sewage disposal. But the I. G. says nothing about the cost of supplying the necessary amount of chlorine for the immense volume of water concerned in beet factory effluent treatment. A simple calculation will show that taking the value of chlorine at its lowest value for generation under the best conditions on the spot it is a fairly expensive undertaking.

pH Determinations.—A. J. RIJKEN, a Dutch chemist,[1] has made a study of the value of the application of *pH* values in beet sugar manufacture, using sulpho-orange (11·0-12·6 ; yellow to orange) for the first carbonatation, and thymol blue (8·0-9·6 ; yellow to blue) for the second. A good indicator for the range 9·6-11·0 suitable for evaporator syrup is still lacking, nitro-yellow and thymol-phthalein, for example, both soon fading. Here are some of the results obtained last campaign with the corresponding figures for the titrated alkalinities ; in terms of grms. of CaO per 100 c.c.

	pH		*Alkalinity*
First carbonatation juice	11·2-11·6	..	0·073-0·119
Second ,, ,, ...	9·2- 9·6	..	0·013-0·022
Thin-juice	9·2- 9·6	..	0·013-0·021
Thick-juice (diluted 1 : 4)	10·0- 9·3	..	0·123-0·038

Filtration of the first carbonatation juice was found to be best accomplished at *pH* 11·4. An important point also investigated was the optimum conditions for obtaining the lowest lime content after the 2nd carbonatation, and in order to realize this the following two rules were put into effect : (1) to add to the lime tanks an amount of soda ash equivalent to the calcium salts present in the second carbonatation juice ; and (2) to carry the second carbonatation to that *pH* value at which after filtration the lowest amount of calcium salts is to be found (using the soap test[2]). This *pH* was found to be 9·5-9·6, a CaO content of 21·0 mgrms. per litre being thus found. However, low lime contents could be obtained only during the first half of the campaign, very varying results being obtained later, though more than the equivalent amount of soda ash was added, the explanation of which is the presence in the juice of a greater or less amount of acids of high dissociation.

PORTO RICO.—The continuance of heavy rains has caused most sugar mills to delay grinding operations. The weather in the extreme southern part of the island has been more favourable and the mills there are the only ones under way. Rains have stimulated the growth of the canes, but have kept the sucrose content unusually low.

HAYTI.—According to a Consular Report, the Haytian-American Sugar Co., of Port-au-Prince, is not only the largest sugar producing and exporting concern in Hayti, but the most important concern of any kind, and gives employment to many thousands. The total exports of raw sugar from Hayti during the year were 12,016 metric tons, as against 9,841 metric tons in 1926-27.

1 *Tijdschrift*, 1928-29, No 6, 140-149.
2 Made by dissolving the pure soap in pure ethyl alcohol.

Boilers and Furnaces.

A summary is here given of some contributions of sugar engineers to the Second Conference of the International Society of Sugar Cane Technologists, recently held at Havana, on the subject of Boilers and Furnaces.

Mr. CONNON (Cuba).—In most of the larger factories in Cuba recent installations of boilers have been chiefly of the water-tube type. There have been some fire-tube boilers installed recently, but not many ; an objection to them being that impurities from the water are liable to settle to the bottom and cause the sheets to bag. Moreover, in large factories the installation of fire-tube boilers necessitates the use of a great many units, as these boilers are so small. Most of the water-tube boilers recently installed have been 600 H.P. or larger ; e.g., 1200 H.P. The greater number are of the straight-tube types, such as Babcock & Wilcox, " Edge-Moor," or cross-drum. One great advantage of the water-tube boiler is that it can be forced to very high capacity. For power-plant work now ratings of 500 per cent. to 600 per cent. of the normal are not uncommon and it is expected that even higher capacities will be usual in the next year or two. Of course, one cannot get anything like that with bagasse at present, but the tendency is in that direction. There is one Cuban factory that is running its boilers between 150 per cent. and 175 per cent. of rating. With a large Cook (" hearth ") furnace one can develop 1400 H.P., but for boilers over 600 H.P. usually two furnaces are put in, so as to force the boilers to overloads. Rio Cauto has Stirling boilers of 820 H.P. each. With one hearth furnace under each boiler they developed 160 per cent. of rating. Last year they installed double furnaces so as to get still greater capacity. Another advantage of the double furnace is that while cleaning you do not have to shut down the whole capacity of the boiler. The general scheme of the " hearth " furnace is shown in Figs. 1 and 2, which illustrate a double furnace of the largest size. Each half of this furnace will develop 1200 to 1400 H.P., or a total of 2400 to 2800 for the double furnace illustrated. There is no grate, the air being supplied by forced draft through tuyères placed in the walls of the fire-pot. The bagasse is heaped up in the furnace so as to cover most of the tuyères. Sometimes the fuel feed is through the front wall as shown, but more usually through the roof directly above the fire-pot. Wood can also be burned in the same furnace. One great advantage over the grate furnace is that cleaning is not required oftener than every 24 to 48 hours. The horseshoe shape is chosen in order to facilitate cleaning. The control of combustion is also easier than in a flat-grate furnace ; with a steady load one can easily obtain 12 per cent. CO_2.

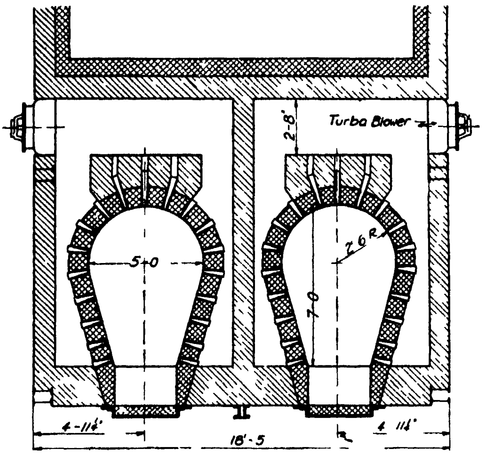


FIG. 1.—Hearth Furnace, Sectional Plan.

Mr. KERR (Cuba)—The fuel-efficiency of water-tube and tubular boilers is about the same. In the company that I am connected with we have a great many of both kinds, and for a long time our lowest fuel consumptions were at factories that had tubular boilers. The advantages of one type as

compared with the other, that is, as regards upkeep and ability to carry overload, hold in the sugar industry as everywhere else. Water-tube boilers can be forced to greater overloads without loss in efficiency than can return-tubular boilers. This means that the total amount of heating surface for the water-tube boiler plant can be less than for tubular boilers. Cuba has made some improvements in boiler-plants in the last two or three years, especially in furnaces. Many furnaces have been built in the last few years with suspended roofs, the so-called " flat-arch " construction. In Cuba there are both flat-grate furnaces and hearth furnaces, and there seems to be little difference as far as fuel economy is concerned, if well proportioned. A flat-grate furnace, if it does not have too much grate surface, thereby permitting too much excess air, can give excellent results. We are inclined to favour the " hearth " furnace, because of its rugged construction and because it can be arranged so that it is impossible to have too much excess air. In other words, by stopping up the tuyères in the furnace or opening more of them we

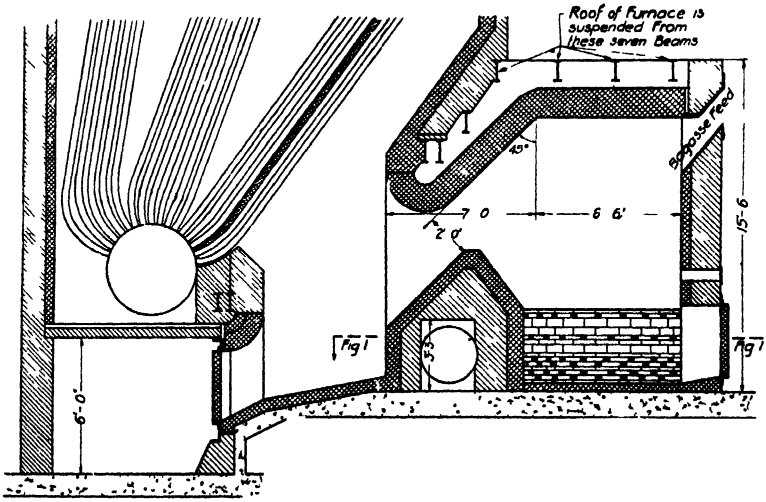


FIG 2.—Hearth Furnace, Sectional Elevation.

can fix the proper amount of air, and thus obtain fair results in spite of inattention and incompetency on the part of the operators. It is easy enough to go into a boiler room and see what the trouble is, but we have found it much harder to have the necessary measures taken for good operating; in other words, to overcome the indifference or prejudice of the men who actually run the boiler room. It is hard to overcome the old ideas and habits in such things, more here than in other countries, on account of the class of labour that we have. Nevertheless, we are making progress in Cuba in cutting down fuel consumption from year to year, all over the island. This year a large proportion of the factories are using practically no extra fuel.

Mr. CLAYTON (C.S.R. Co., Australia).—In our Australian mills most of the boilers are multi-tubular, whilst in Fiji the loco. type predominates. The former are always erected in a continuous setting, all cleaning of furnaces and flues being done from the front and back ends. For burning bagasse only, the solid hearth furnace fitted with a " pyramid " grate is favoured. The grate is of the stepped type made in the shape of a half cone, the bagasse dropping on the apex and being evenly distributed over the surface. For a

wood and bagasse furnace, flat grate bars are substituted for the solid hearth and the pyramid is omitted. Our loco. type boilers are really coal-burning units and are used for this purpose at mills using coal for their supplementary fuel. When employed as bagasse boilers, separate furnaces with solid hearths and pyramid grates are erected in front of the steel fire-box. Some medium sized water-tube boilers have recently been installed but have not yet been put into regular work. At one period the discharge of charred bagasse from the chimney created a considerable nuisance ; this has been largely overcome by increasing the dimensions of the furnaces, at the same time improving the design. I believe our mills have as great a volume of furnace plus combustion-chamber, per unit of bagasse burned, as others have. The moisture of the bagasse entering the furnace is about 30 per cent. Induced draft fans and comparatively short chimneys are in general use at our mills, though some factories still rely on chimney draft only. The use of short chimneys is not altogether on account of liability to damage from cyclones, though this is an important consideration in some districts. We do not get high ratings out of our fire tube boilers ; they do not lend themselves to forcing.

Dr. van Harreveld (Java).—In Java our furnaces are nearly all of the same type, having a grate of rather steep incline. The bagasse is fed by hand, with care to admit as little air as possible through the feed-openings. In the last few years we have tried to make larger furnaces with more combustion space and with extra air admitted above the fire. We believe that the principal factor in good combustion is the man who handles the furnaces. Many factories use automatic gas-analysers for CO_2 and CO, and find them very useful in showing the best method of handling the furnaces. In Java you do not often see badly smoking chimneys.

Correspondence.

Dr FRANCIS MAXWELL.

To the Editor of "The International Sugar Journal."

Sir,—Since the amalgamation of interests of Messrs. George Fletcher & Co., Ltd., and the Sugar Machinery Mfg. Co., Ltd., of which latter firm I was Chairman, there appear to be erroneous notions abroad as to my present professional activities and connections. I should, therefore, be glad if you would be good enough to allow me space in your Journal to explain my exact position.

Briefly, I now have no connections whatever with any sugar machinery firms, either at home or abroad, apart from certain firms being licensees of my patents.

I continue to act as consulting engineer and sugar technologist at my office, 334-5, Abbey House, Victoria Street, London, S.W.1.

Yours faithfully,

Francis Maxwell.

"Chemical Patents Index" has just been issued in the U.S. It is edited by E. C. Worden, whose name is well-known to those concerned with the cellulose industries. It provides an index to all the chemical patents and re-issues granted in the U.S. during the 10-year period, 1915 to 1924, inclusive. The labour involved in such a task is truly immense, and these volumes should prove a great stimulus to chemical inventiveness, indicating as they will, almost at a glance, the state of prior knowledge on the subject.

Publications Received.

The Recovery and Use of Industrial and Other Wastes. John B. C. Kershaw; with Foreword by Sir Max Muspratt. (Ernest Benn, Ltd., London). 1928. Price: 25s., net.

It is the purpose of this book to review what has been accomplished in a general way in the recovery of technical waste products. Its perusal is highly interesting, showing well as it does the great achievement of the chemist in a number of different fields. For example, cinders and ashes are being treated in certain industries for the recovery of the unburnt coal or carbon which they contain. Oil recovery is current practice in several industries using large quantities of it. In making lime on the large scale the formation of "smalls" and "knottings" is avoided by employing rotary instead of shaft kilns, these being fired by means of producer gas. Alcohol is being made from sulphite waste liquors, and active carbon as well as fertilizer from the same by-product. Under the heading of "Sugar and Sugar-beet Wastes" a number of proposed methods of utilization are summarized, and, while on the whole this chapter is satisfactory, some of the matter might well have been replaced by other data, some for instance dealing more particularly with effluent disposal. On the whole, however, the book should prove a useful one. Every industry now-a-days is concerned with the utilization of its waste products, and it is certain that chemists working in this direction cannot do so in water-tight compartments, but must be cognisant of what is being done by their fellows working in other branches.

An Introduction to the Chemistry of Plant Products. Paul Haas and T. G. Hill. Volume I: On the Nature and Significance of the commoner Organic Compounds of Plants. Fourth Edition. (Longmans, Green & Co., London). 1928. Price: 18s. net.

HAAS and HILL's excellent work, which was favourably reviewed in these columns on the appearance of the first and third editions,[1] has once again been revised and somewhat enlarged. Its subject matter, as was pointed out previously, deals with the occurrence, chemistry and physiological significance of the chief products of the plant's activity, viz., carbohydrates, glucosides, fats, proteins and enzymes. It forms a most useful book of reference on a subject with which it is surely of interest to be acquainted, viz., the manner in which sugars are initially formed by the plant, and the rôle of products such as starches, gums, tannins, pigments, proteins, etc., in its physiology. A chapter has now been added on hydrogen-ion concentration, and its importance to the growth of the plant.

Sugar Manual, 1928: Statistics of Sugar Companies. (Dependable Publishers Ltd., 87, Bishopsgate, London, E.C.2). 2s. 6d.

This Manual is in its second year, and since the first edition came out in 1927 has been improved and enlarged. Its main contents consist of particulars of various British, American and overseas sugar companies on the lines of a stock exchange year book. Some 60 companies are mentioned, and the usual financial particulars appended. In addition, there is a section on the Home beet sugar industry, with lists of factories and their proprietaries, particulars of the home beet production, Customs and Excise tariffs, and a number of tables of leading sugar statistics. Altogether a useful handbook to have at one's elbow.

Diatomite: Its Occurrence, Preparation, and Uses. By V. L. Eardley-Wilmot. Report No. 691; Department of Mines, Canada. 1929.

Canada possesses valuable kieselguhr deposits in different localities, the most extensive of which are at Quesnel (B.C.). These yield material which is very satisfactory for many purposes, but is said to be "not entirely suitable" for the filtration of sugar juices and liquors. This Report covers kieselguhr in general in a particularly thorough way, being in fact a very well-written monograph on the subject.

[1] *I.S.J.*, 1913, 579; 1921, 223

Brevities.

CANE HARVESTERS.—A new cane harvester was recently demonstrated successfully in Queensland by W. L. Miller and F. J. Owen in a field of burnt cane yielding about 30 tons per acre.[1] The petrol consumption was estimated to work out at 1½d. per ton of cane (cut and topped).

POWER ALCOHOL from wood will be made with the participation of the Distillers' Co., Ltd., and its subsidiary, International Sugar and Alcohol Ltd. at Stettin. Further works are contemplated in Germany. The work will be put in hand through the Holzhydrolyse Company of Heidelberg, on whose board Sir James Calder sits as representative of the English group.

"THE SAMPLER has to my mind one of the most important, if not the most important, jobs in a laboratory. His is one that requires the most vigilance, care and commonsense. There can be no check on the sampler's work after the cane has passed through the mill. The only assurance therefore of reliable work is the sample boy's devotion to his duty."[2]

PAPER MANUFACTURE.—C. A. Robak[3] calls attention to the patents of the Swedish chemist, E. L. Rinman, according to which, in the manufacture of paper, cooking and washing are so carried out that the glutinous substances of the straw or similar material (esparto, bagasse, etc.) are not dissolved, but serve later as binding agent. Bleaching can be carried out as ordinarily.

THE ZEISS HAND REFRACTOMETER recently described[4] has found application by J. A. Verret and A. J. Mangeldorf[5] in the selection of cane seedlings, the juice from small segments being pressed out with pliers to provide the necessary few drops for the reading. About 1500 observations can be made each 7 hours. There is a close correlation between the total solids thus ascertained and the sugar content.

CANE AND SUGAR PRODUCTION statistics for Java during the past 18 years[6] show a considerable variation from year to year, but it is also clear that the general trend is upwards. Thus the short tons of sugar per acre were 4·50 in 1910; 3·89 in 1915; 4·40 in 1920; 5·73 in 1925; and 6·67 in 1928. This last high figure is attributed to the new variety POJ 2878, said to have occupied 68 per cent. of the area for the last Java crop. Other figures show the gross production, which during the past 19 years has increased about 129 per cent., the area in cane having increased about 56 per cent. during the same period.

BRITISH PATENTS.—The British Science Guild Report on the reform of the British patent system contains a few proposals which, if made law, would improve existing conditions. One useful suggestion is that the Patent Office search in respect of novelty should be extended to documents other than British Specifications. If adopted, this would legalize the existing informal action of chemical examiners, who frequently, for the purpose of assisting the applicant, draw his attention to publications of which they are aware. Another useful suggestion is that a patent should not be invalidated by prior publication occurring in any document more than fifty years older than the patent itself.

CHLORINE IN THE SOIL.—In a recent paper entitled "The Chlorine Question in Java Cane Cultivation," Dr. O. Arrhenius[7] produces figures from cultures with POJ 2878 and POJ 2883 showing for different types of soils the definitely dangerous limits, viz., clay, 0·06; loam, 0·036; and sand, 0·12 per cent. of the dry soil, expressed as Cl. On the other hand, he has determined the chlorine contents beneath which the chlorine never causes any damage, these being 0·024, 0·012 and 0·001 per cent. respectively. Maps are given of the areas of two factories, Bandjaratma and Assembagoes, showing the distribution of chlorine in the soil. The highest content is in the plains near the coast; which is not caused by infiltration from the sea, but from the concentration of the drain water from the higher lying parts.

1 *Aust. Sugar J.*, 1928, **20**, 501-503. 2 BENJ. J. HOLLERO in *Sugar News*, 1928, **9**, No. 12, 878-879.
3 *Ind. & Eng. Chem.* (*News Edition*), 1928, December 10th, 1928.
4 *I.S.J.*, 1928, 616. 5 *Hawaiian Planters' Record*, 1928, **32**, 427.
6 *Archief Mededeelingen*, 1928, No. 6, also *Sugar News*, 1928, **9**, No. 12, 876-877.
7 *Archief*, 1928, **36**, II, No. 5, 90-100.

SUGAR IN PERSIA.—About two million pounds' worth of sugar is annually imported into Persia, and it is now reported that an expert in beet sugar cultivation and manufacture has been invited to report on the best means of establishing an industry there. It is likely that as the result of this investigation tenders will be invited for machinery.

GLYCERIN PRODUCTION.—This process of alcoholic fermentation using beet molasses was recently described in the German technical press,[1] the process being essentially that used in Germany during the war. Beet syrups are suitably diluted, boiled for an hour with peat powder, and caused to ferment with a top yeast in alkaline medium in the presence of sodium and calcium bisulphates and manganese compounds with certain yeast nutrients.

ANTIFERMENTS.—Ellery H. Harvey[2] has determined the value of thirty-two typical essential oils in preventing the hydrolysis of sugar by yeast. Clove, cinnamon, thyme, and wintergreen were found to rank high in effectiveness. Absorption of ultra-violet radiation affected both the colour and the antiferment value. Such oils should be kept in brown bottles, and not in blue or clear glass bottles. Acetic acid, in concentrations above 1·5 per cent., was found to be an efficient antiferment.

HAWAII IN 1927-28.—Agricultural interests in Hawaii report having had a satisfactory year to June 30th, 1928. The sugar industry reported a steady gain in production without a corresponding increase in acreage, a fortunate circumstance as the increase in production compensated somewhat for the lower average price of sugar. The crop for the 12 months ending 30th September amounted to 903,000 short tons (806,250 long tons), an 11 per cent. increase over 1927, when 811,333 short tons was produced.

MR. J. K. THOMPSON, who is Lecturer in Agriculture at the Kirton Institute (not Director, as was erroneously stated) asks us to make it clear that his conversation with Dr. Rabbethge referred to on page 32 of our January number did not cover the whole ground of the contents of the article which we summarized. The conversation simply elicited and emphasized the fact that the German beet-growing farmer attaches great importance to his tops for stock feeding, and that the tops thus used play an important economic part in the German industry.

MOLASSES FORMATION has again been examined by O. Spengler, F. Tödt, and Ch. Shen[3] who confirm Schukow's observation that the effect of the salts in increasing the solubility of sugar is inversely proportional to the hydration of these salts.[4] It follows therefore that the melassigenic effect of a salt is to be judged by its state of hydration, the higher the hydration, the lower its melassigenic effect. According to this conception of the problem, therefore, calcium chloride is less melassigenic than say sodium chloride or potassium chloride.

XYLOSE PRODUCTION is attracting attention in America.[5] It is reported that the Bureau of Standards is co-operating with certain interests in Alabama in the erect on of an experimental factory for the recovery of this rare sugar from cottonseed bran and peanut shells on a semi-commercial scale, the output to be about 100 lbs. per day with a manufacturing cost not exceeding 50 cents. per lb. It is believed that this sugar possesses properties which ought to make it useful for use in the food, textile and leather industries.

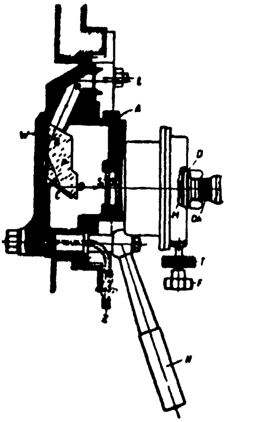
META-FILTERS.—J. A. Pickard describes a development of the edge filter,[6] consisting briefly in making filtering leaves built up of perforated strips of substantial dimensions provided with bevelled edges. These filtering strips are separated precisely and to a predetermined extent by providing a rib of definite height while the internal perforations arrange for drainage channels. Such a filter can be constructed of almost any metal or durable material; can be cleaned easily by simple flushing; can be sterilized; and can be used for any pressure or temperature. It is claimed that a high speed of filtration can be realized; and that the fineness of filtration can be adjusted at will, even down to 0·1 micron (bacteria being seldom smaller than 2·0 microns). This should be an apparatus of extreme interest in the sugar industry if its claims can be realized in technical-scale practice.

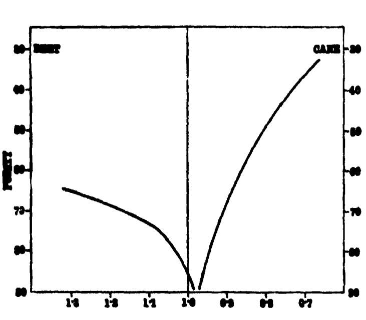
[1] *Chemiker Zeitung*, 53, No. 2. [2] *Am. J. Pharmacy*, 1928, 100, 524-529. [3] *Vereins-Zeitschrift*, 1928, 747-759. [4] *Ibid.*, 1900, 291-321. [5] *Technical News Bulletin*, No. 140, p. 169. [6] *The Industrial Chemist*, 1928, 505-508.

Review of Current Technical Literature.[1]

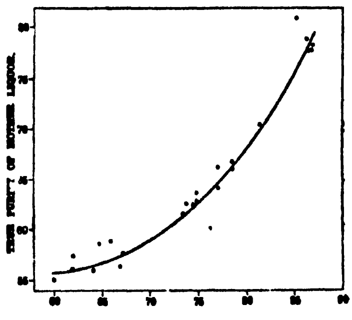
Pan Boiling: Its Scientific Control, using the Zeiss Refractometer. S. J. Saint.[2] *Tropical Agriculture*, 1928, **5**, 279-283.

In this article the author outlines the theoretical considerations on which the scientific control of pan boiling must be based; then shows how use may be made of the Zeiss pan refractometer for the boiling of cane syrups.[3] Claassen was the first to establish a definite theoretical conception of the boiling process equating the several variables as follows: $W = \frac{100\,R}{C_1C_2Lt.+R}$, R where R=purity, C_1=saturation coefficient, at purity R; C_2 = coefficient of supersaturation; W = water content; Lt = solubility of sucrose in water at t°C. His data showed the solubility of sucrose to be greater in beet juices than in water; whereas according to the results recently published by Thieme[4] in Java it is less in cane juices (Graph 1). No wonder, therefore, that the applications of Claassen's methods to cane juices have heretofore always failed. At the Sandy Lane Factory, Barbados, scientific pan control according to Claassen's ideas, while taking account of this later work in Java, was instituted, the concentration of the mother-liquors being determined by means of the refractometer, in place of the brasmoscope, which latter was difficult to apply, and yielded less accurate results. At Sandy Lane Factory the 3-strike system (Geerligs' "absolute recovery" process) was in use, and the purities at different levels of the pan for the *A*, *B*, and *C* strikes were determined. From the purity of the syrup and of the molasses points were calculated from which a curve was drawn giving the purity at all levels. It was necessary to determine the relationship between the purity of the mother-liquor and that of the massecuite under the conditions of ordinary pan boiling (which was done by rapidly filtering the hot massecuite through muslin on a Buchner funnel). These data were expressed in the form of a curve (Graph 2) giving the purity of the mother-





Graph 1: Saturation Coefficients for Cane and Beet Juices.



Graph 2: Relationship between Purity of Massecuite and Mother-Liquor.

liquor, that of the massecuite being known. This gave R, the purity of the mother-liquor, while from Thieme's data, C_1, the saturation coefficient at this purity, was found. In calculating tables for use with the refractometer it was necessary to know the purity of mother-liquor at given levels in the pan and also the saturation

---

2 Department of Science and Agriculture, Barbados, B.W.I.

3 Lowe: *I.S.J.*, 1925, 667. Also Kucharenko: *I.S.J.*, 1927, 649.

4 *Archief*, **34**, Nos. 47 and 50; **35**, Nos. 2, 3, 8, 11, 16 and 19.

coefficients at those purities. In *using* such tables, however, the purity of the mother-liquor and the saturation coefficient were eliminated and only the level of the massecuite in the pan considered. Knowing the temperature, the solubility of sugar at that degree was found. Regarding the coefficient of super-saturation, THIEME found 1·2 to be the most practical to maintain ; at Sandy Lane 1·15 was found the optimum for first strikes, and 1·2 for *B* and *C* strikes. Having defined three of the variables R, C_1, and C_2, it remained to give values to the temperature in order that the concentration might be determined. Vacuum, at most factories, varies very little and as concentration, temperature and vacuum are connected variables, the concentration at any particular vacuum can be calculated with the aid of the data obtained by THIEME for the elevation of the boiling points of cane juices. Hence vacuum was substituted for temperature in order to introduce additional simplification. In this way tables were constructed for *A*, *B* and *C* strikes which proved very simple to use in practice. The Table following represents the actual one successfully used at Sandy Lane for C strikes, which covers the range of purities for this type of strike and the ranges of vacuum prevailing in the pan.

Level of Massecuite in Pan.	Vacuum		
	24 in.	24½ in.	25 in.
20	82·0	81·7	81·4
40	85·2	84·8	84·2
60	85·9	85·5	85·1
80	86·2	85·8	85·5
100	86·5	86·2	85·9
Strike at	88·0	87·7	87·4

In using such a table, it was only necessary to observe (*a*) the level of the massecuite in the pan and (*b*) the vacuum. The correct concentration for the mother-liquor in the pan was then read from the table. If the concentration as shown by the refractometer was too high, then the inlet valve was opened more, whilst if the concentration was too low it was closed until the correct concentration was registered. It was found an easy matter to teach the pan boiler to use the refractometer in conjunction with such a table and this method of boiling was preferred to the more laborious method of taking proof-stick samples.

TRYING OUT THE OLIVER FILTER IN HAWAII. **W. L. McCleery.** *Annual Report of the Experiment Station, Hawaiian Sugar Planters' Association*, 1928.

Two additional Oliver filters were installed at Oahu Sugar Co., Ltd., making three units in use at this factory during the present season. One has been installed at Olaa and has been in use since April 7th. These filters are all of the same size, 8 ft. in dia. and 12 ft. in length, having 300 sq. ft. of filtering surface. Mr. BOMONTI co-operated in starting the Oliver filters and remained there during several weeks of operation. After a few difficulties had been overcome, they operated satisfactorily. It was found necessary to allow somewhat more "cush-cush" to pass into the juice before the settlings could be filtered without difficulty. Previously the fibre in the suspended solids of the settlings had been very low, or about 18 per cent. After the screens at the mill were changed so that the fibre percentage was increased to about 27 per cent., the settlings filtered without difficulty. Settlings from 35 or slightly more tons of cane per hour were handled, and the cake polarization averaged between 1·5 and 2 per cent. Recent tests conducted by Mr. BORDEN indicate that with a 2 in. instead of 1 in., spacing of the wire holding the cloth, somewhat greater capacities can be secured and less frequent scrubbing of the cloth is required. On the whole the filter at Olaa has operated satisfactorily. This is of decided interest as a great deal of difficulty has always been experienced in filtering the settlings at this factory, which is classed as one having the most refractory settlings. The reason for this was that the fibre content in the suspended solids in the settlings was too low, approximately 20 per cent. It is encouraging that this second attempt of installing modern filtration equipment in an Hawaiian cane sugar factory has worked satisfactorily.

This is the second season that it has been possible to work with such equipment, so that many of the ideas are still new, and there are great possibilities of improving their application. This writer adds that in view of the situation as a whole it would seem most advisable for factories in his territory at which the filtration equipment is insufficient or unsatisfactory to co-operate in the adaptability of modern equipment, rather than to install new presses which at best are unsatisfactory.

PREVENTION OF SUGAR LOSSES DURING MILLING BY THE USE OF CHLORINE. **J. N. Sarkar.** *La Revue agricole de l'Ile Maurice*, 1928, No. 42, 258-263.

The prevention of deterioration of cane juice by the addition of "E.C." or formaliin is partly dependent upon the initial purity of the untreated juice. It has been noted by Dr. HALDANE in an article[1] that in all cases of untreated mill juice souring occurred after 3-5 hours standing, while in those samples treated with "E.C." no souring could be detected even after 24 hours and souring was noted in the untreated samples after one hour's standing. From this it may be concluded that although the inverting activity of the micro-organisms can be suppressed by the addition of "E.C."[2] or formalin a loss of sucrose dependent upon the acidity concentration and temperature will generally be recorded. Mr. C. M. HUTCHINSON in Bulletin No. 163, published by the Government of India from Pusa observed "the reduction of inversion rate as a result of the suppression of the activity of micro-organisms by the use of the antiseptic "E.C." is sufficient to make differences of practical importance." The available chlorine concentration of "E.C." is about 2 per cent. and this diluted to 1 part in 500 for use in the factory gives a chlorine strength of 1 in 25,000. This dilute solution was used to sprinkle the mills before crushing; the bagasse carrier was also sprinkled occasionally during the crush. Dr. HALDANE recommends periodical washing of different mills, mill-beds, gutters, cheeks, etc., during milling operation and a spraying of "E.C." containing 2 per cent. available chlorine, further a continuous trickle of the antiseptic diluted to 1 part in 500 at the beginning of the season and increased to 200 towards the end of the season. The author however, as a result of his trials in a large number of mills in India, and recently a few in Mauritius, recommends the following procedure to be adopted:—A wash-down of the crusher, mills, gutters, channels, mill-beds, and strainers with a solution of 1 part in 500 to 200 parts of water before starting operations and every time after stopping work for four hours or longer. The measuring tanks, juice-heaters and defecators should be washed with the solution at least once and if convenient more frequently, every day. The crushers, different mills, mill-beds, channels, gutters and strainers should be sprayed with "E.C." every 8 to 3 hrs., and a dilute solution should be allowed to trickle into the juices used for imbibition and going into the sulphitation, or carbonatation tank as the case may be. For spraying 1 part in 5 to equal parts of water and for trickling 1 in 300 to 100 water depending upon the loss of purity of the juice and temperature should be used. If the loss of purity is 2 per cent. or more "E.C." full strength for spraying and a solution of 1 in 50 for trickling is recommended Under normal conditions ½ to 3 gallons of "E.C." per day according to the quantity of cane crushed and the temperature is sufficient to keep the mills in a fairly sterile condition. But if loss of purity is recorded, indicated by the lower purity of the clarified juice than that of the mixed juice, 1 to 6 gallons of "E.C." for every 200 tons of cane crushed is necessary according to the loss of purity and temperature for regaining a fairly sterile condition in the mills. For preserving juice in defecators, etc., pour in 1 part of "E.C." for every 20,000 parts of the juice to be preserved and repeat every 12 to 4 hours according to the inverting activity present in the factory and at the temperature prevailing. Wherever presence of inversion is suspected in the mills either by the appearance of slimes or by smell the parts so suspected should at once be cleansed and then washed with "E.C." solution. Maintenance of the milling plants in as sanitary a condition as possible is of vital importance. The major portion of the quantity of "E.C." recommended should be used in spraying and washing. It has been observed that a loss of purity of 1 per cent. through the de-

1 *I.S.J.*, 1927, 367.

2 "E.C." means electrolytic chlorine generated on the spot in a small convenient plant which is now on the market.

terioration of the juice corresponds to a loss of 1 per cent. of sucrose and a further deterioration of 1 per cent. in the boiling house efficiency; and corresponding to a gain in purity of 0·5 per cent. by treatment with " E.C.," the sugar saved can be modestly estimated at 0·4 per cent. of the total sugar realized, which saving has been found to have been effected by using " E.C." at 5 gallons per 100 tons of cane crushed when the loss of purity was approximately 12 or, in other words, 8 cwt. of sugar valued Rs. 80 (at Rs. 9 per 100 lbs.) can be recovered at a cost of Rs. 35 taking " E.C." at Rs. 7 per gallon. The relative figures for a gain in purity of 1·5 per cent. are 0·70 per cent. and 1·10 per cent., i.e., 14 cwts. of sugar or Rs. 140 saved by using 10 gallons " E.C." at a cost of Rs. 70, and 1 ton 2 cwt. of sugar or Rs. 220 saved by using 20 gallons " E.C." at a cost of Rs. 140 respectively.

Some Adsorption Properties of Bonechar. **T. B. Wayne.**[1] *Industrial and Engineering Chemistry*, 1928, **20**, No. 9, 933-940.

In this paper are presented numerous tabular data resulting from experiments on the adsorptive power of ordinary refinery char, the method of working in general being to add 50 grms. to 200 ml. of the test liquor (calcium acetate solution, crystallizer remelt syrup, raw sugar solution washed sugar liquor, etc,), contained in flasks, connected up with reflux condensers, and placed in a water-bath at 80°C. The flasks were shaken for 30 secs. at 15 min. intervals, and removed at the end of an hour, the filtrates being analysed electrometrically for ash, total solids, and *pH*. The author's discussion of his results is as follows : " While the seat of the ash-adsorbing powers of bonechar may be regarded as in the mineral skeleton, an adsorbed layer of alkaline substances within the char exerts a very great influence on adsorption of ash from sugar solutions and solutions of calcium acetate. Chars that have been washed prior to testing absorb less ash than chars that have been burned to such temperatures that a layer of alkaline substances is formed at the interfaces of the char and becomes available for exchange reactions which undoubtedly occur during adsorption. On increasing the alkalinity of the chars within certain limits, and then extracting them with successive portions of distilled water under conditions which allow the char and extract to remain together and establish an adsorption equilibrium, they will yield filtrates having higher *pH* values but lower conductivity. On the other hand, if the chars are severely overburned, both the *pH* and conductivity of the distilled water extracts will increase. Chars having insufficient alkalinity will adsorb less ash and also yield acid filtrates. The latter is suggestive of a form of hydrolytic adsorption and occurs on all sugar solutions and calcium acetate solutions. Lowering of the *pH* by such chars occurs regardless of their calcium carbonate content, and the alleged buffer action of the char carbonates cannot be depended upon to neutralize the acidity so formed. From the data presented, the conclusion may be drawn that in actual refinery practice one may expect ash adsorption to be increased through revivification of chars at the highest temperature that is consistent with certain other considerations, notably the relation between *pH* and decolorization or the subsequent darkening of granulated syrups. In attempting to evaluate the comparative ash-adsorbing powers of chars, if *pH* is not considered or if the chars are washed before using, very erroneous results are liable to be obtained. The same may be said of attempts to compare the reactions of liquors which are treated by various chars. The results for bonechar of Van der Zwet[2], which have been extensively advertised by the manufacturer of a well-known vegetable carbon, may be explained on this basis. In the actual char-filtration experiments described, there is considerable invert sugar disappearance at the beginning of the filter cycle while the char is fresh and highly alkaline. Less invert sugar appears in the filtrates from the more alkaline chars, but the data are insufficient to indicate whether this apparent disappearance is due to adsorption, invert sugar destruction, or analytical error caused by an alteration of the copper-reducing powers. However, there is considerable evidence that invert sugar is released by char as soon as the density changes in sweetening-off the char."

[1] Imperial Sugar Co , Sugar Land, Texas.
[2] *I.S.J.*, 1927, 112.

Review of Current Technical Literature.

SOME ERRORS OF LABORATORY PRACTICE. **Norman Bennett.** *Twenty-Eighth Annual Report of the Bureau of Sugar Experiment Stations, Queensland,* 1928. Since his return from studying methods in other countries, Mr. BENNETT has visited Queensland factories for the purpose of instituting some system of mutual chemical control on generally approved lines. Incidentally he has noticed the following errors in laboratory practice in these factories :—(*i*) Indiscriminate use of flasks graduated at 15°C., 17½°C., and 20°C. (*ii*) Use of balances insufficiently sensitive. (*iii*) Indiscriminate use of 26·048 gm. and 26 gm. normal weights. (*iv*) Use of tables in SPENCER's "Handbook" for HORNE's dry lead method based on 17½°C. when Brix spindles graduated at 27½°C. are used. (*v*) Use of polariscope scale graduations based on Bates-Jackson scale of the U.S. Bureau of Standards and not on the International Scale. (*vi*) Calculation of sucrose extraction figures for various mills of a tandem on the basis of an assumed constant purity for the residual juice in the bagasse varying from 66⅔ to 80 per cent. (*vii*) Entire disregard of the sucrose in molasses held in stock when calculating the weekly sucrose balance.—DETERMINATION OF DEXTROSE USING ALKALINE IODINE SOLUTION. **K. Douwes Dekker.** *Archief, Mededeelingen,* 1928, No. 12, 669-720. A modification of ROMIJN's method,[1] stated to give sufficiently precise results even when sucrose is present in moderate proportions, is carried out by introducing into a Erlenmeyer flask 25 c.c. of the solution under examination containing about 30 mgrms. of dextrose, then 10-15 c.c. of N/10 iodine solution and 100 c.c. of a solution containing 14·7 grms. of sodium bicarbonate and 2·8 grms. of sodium carbonate. After closing the flask (it should be glass-stoppered), it is placed for 40 min. in a dark place, acidified with 12-15 c.c. of 25 per cent. sulphuric acid solution, and titrated with N/10 sodium thiosulphate solution. Results thus obtained are about 1·8 per cent. too high, while sucrose appears to have a reducing power which is about 0·25 per cent. that of the dextrose. —REPORT OF THE NEW YORK SUGAR TRADE LABORATORY. **F. W. Zerban.** "The total number of samples tested during 1928 was 20,782, a slight decrease from the preceding year. These samples represented an average of 1666 packages each, against 1648 in 1927, and 1680 in 1926. The average polarization of all samples was 96·41, the same as the year before. The highest monthly average was 96·62, in April, and the lowest was 95·93, in July, a difference of 0·69. However, a considerable number of damaged sugars were received in July, depressing the average polarization. Not considering this abnormal month, the spread between the highest and lowest average was only 0·39. The percentage of samples testing between 96 and 97 has fallen from 65·31 in 1927 to 63·07 in 1928, but that of samples between 97 and 98 has risen from 15·08 to 17·25. There was a further slight reduction in the relative number of samples polarizing between 95 and 96, from 15·60 per cent. to 15·15 per cent. The lower grade percentages were practically the same as in 1927."—RAPID DETERMINATION OF WATER IN SUGARS. **D. Sidersky.** *Bull. assoc. chim. sucr. dist.,* 1928, **45**, 247-249. The sample was placed in a capsule inside a glass tube through which air at 108°C. was passed into a $CaCl_2$ tube, which was weighed. Using first-jet beet sugars, constant weight both of sample and of $CaCl_2$ tube could be attained in 2 hours ; and in 2½ to 3 hours with 2nds. and lower grades. But with raw cane sugars constancy of weight could not be reached even in 6 hours, due no doubt to slow decomposition of reducing sugars, mainly levulose.—MECHANICAL REMOVAL OF SCALE FROM EVAPORATOR TUBES, ETC. **Louis Borsu.** *La Sucrerie Belge,* 1928, **48**, No. 11, 201-205. Descriptions are given of the Büttner, Ingersoll-Rand, Fruchard and Devoorde apparatus, the last being a device with several rotation wheels of gradually increasing diameter, electrically operated. Regarding the last-named, after having used it for three years, the author found it to give entire satisfaction, being capable in fact of cleaning an incrusted tube to make it like new. It can be used for boilers, carbonatation tanks, liming tanks, condensers, and scum presses. It is an apparatus of great use in the sugar factory, being efficient and labour-saving.

J. P. O.

---

[1] *Zeitsch. anal. Chemie,* 1197, **36**, 349.

Review of Recent Patents.[1]

UNITED KINGDOM.

PRODUCTION, APPLICATION, AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **O. Schober**, of Stuttgart, Germany. 298,546. June 9th, 1927. (*B*) **I. G. Farbenindustrie A.G.**, of Frankfort-on-Main, Germany. 301,313 November 23rd, 1928; convention date, November 26th, 1927. (*C*) **A.-G. für Stickstoffdünger**, of Cologne, Germany. 301,330. November 26th, 1928; convention date, November 26th, 1927. (*D*) **Metallbank und Metallurgische Ges. A.-G.**, of Frankfort-on-Main, Germany. 302,774. November 1st, 1927.

(*A*) An adsorption agent containing at least 10 per cent. of free carbon and more than 20 per cent., e.g., 30-40 per cent. of ash soluble in hydrochloric and like acids is produced by treating carbonaceous materials with oxidizing gases or vapours, or mixtures thereof, at activation temperatures. Coal, brown coal, peat, coke and other substances of vegetable origin and rich in acid-soluble ash forming constituents may be used as starting materials. (*B*) Active carbon is refined by treatment with an electrolyte, the anions of which are strongly adsorbed but are non-injurious or are easily removable, or both. The treatment prevents corrosion of iron and other metal apparatus by the carbon. The electrolyte may be a salt, more especially a salt of a weak base, or a free acid, such as nitric acid, or an electrolyte containing the acetate or other organic anion. Iron, zinc, or other nitrate may be used. The carbon may be repeatedly heated with the same or a different electrolyte which may finally be removed, e.g., by washing or steaming, or by chemical means or by heat. The heat treatment may be conducted so as to produce a further activation of the carbon. The treatment of active carbon obtained by carbonization of sawdust in the presence of zinc chloride and containing sulphate and chlorine ions is described, the carbon being boiled twice with 5 per cent. nitric acid, with an intermediate filtering, and the nitric acid being removed from the carbon by washing with distilled water. The carbon obtained is suitable for medicinal purposes and for refining glycerin. (*C*) Active carbon is obtained by sorting, for example in a sieve, the ashes left in the combustion of coal, lignite, wood, or peat, more especially the ashes carried into the flues, and purifying in the usual manner the active products so obtained. (*D*) Active carbon of high absorptive power and mechanical strength is obtained by heating fine-pore vegetable materials, such as plum stones, coconut shells, and other hard shells, which are broken up into small pieces, with a concentrated solution of zinc chloride, the weight of zinc chloride employed being less than that of the vegetable material treated. In an example 100 kg. of plum stones which have been broken and the kernels removed are treated with a concentrated liquor at 100°C. containing 70 kg. of zinc chloride. The mixture is dried at about 200°C., and then heated to 700°C. The zinc chloride is extracted with hydrochloric acid and water from the carbonized residue which is next dried, broken up and sieved.

MANURES. **J. Y. Johnson** (communicated by the **I. G. Farbenindustrie, A.-G.**, of Frankfort-on-Main, Germany). 300,329. August 24th, 1927. Mixed fertilizers are obtained by mixing urea with aluminium phosphate or iron phosphate or with mixtures of these phosphates. Mixed aluminium and iron phosphate obtained on neutralizing with ammonia, for the recovery of ammonium phosphate, the phosphoric acid formed by dissolving raw phosphates, may be used. Potassium or other fertilizing salts may be added.—TOPPING BEETROOTS, ETC. **N. Nielsen**, of Hassing, Denmark. 300,342. September 8th, 1927. Beets or other root crops are topped by an horizontal knife with an oblique edge, the knife being positioned for the cut by two guiding plates carried on rods connected at their forward end by a U-piece and suspended in front by a chain or a pair of chains and at the rear by a chain. A chain or pair of chains, also secured to the front end of the rods maintains them a

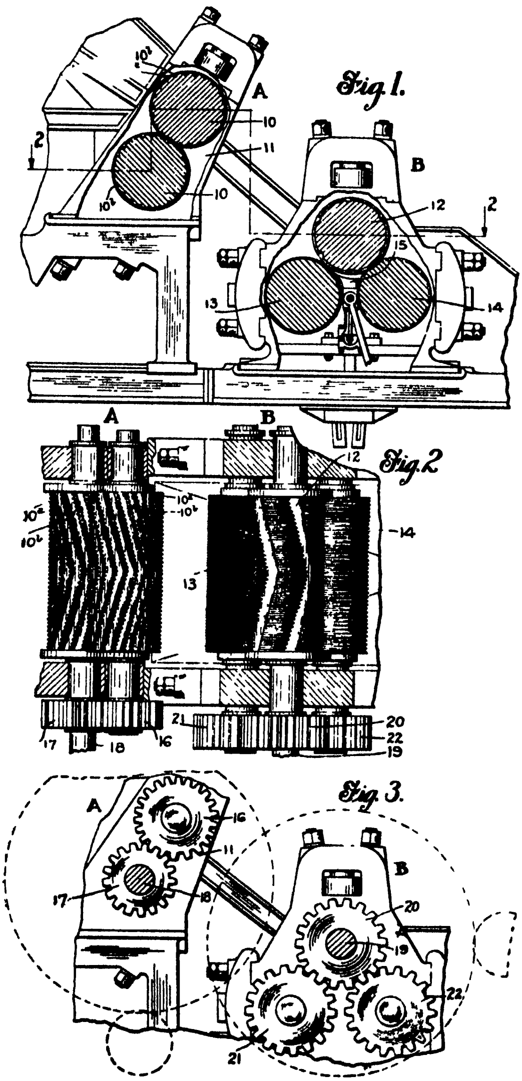
[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

little further backwards than the position they would take up under the support of the chains alone. A plate at the rear end of the rod supports the knife. A curved plate and a rod direct the cut-off tops to one side.—FILTERING LIQUIDS. **A. Gronning,** of Hellerup, near Copenhagen, Germany. 300,600. August 16th, 1927. In a filter or strainer comprising superposed discs having a narrow projection to form a narrow filtering slit between adjacent surfaces, a projection is made zig-zag between the inner and outer edges of the disc and thus separates radial supply and discharge channels on the surface of the plate. The discs are clamped together by a bolt in a housing and have projections on one surface which determine the depth of the slits. —SACCHARIFICATION OF WOOD. **Holzhydrolyse A.G.** (assignees of **E. Haggelund,** of Abo, Finland). 302,313. December 13th, 1928; convention date, December 14th, 1927. The carbohydrate obtained by saccharifying wood with hydrochloric acid is freed from traces of the acid by wet grinding it with an oxide or hydroxide of an alkaline earth metal, e.g., in a porcelain ball-mill, and immediately dehydrating, preferably by centrifugal action, and washing with a little water. The carbohydrate is re-formed in the usual manner. The waste liquors may be fermented or worked into yeast.—CITRIC ACID BY THE FERMENTATION OF SUGARS. **Montan & Industrialwerke vorm. J. D. Starck,** of Dolni Rychnov, near Falknov, Czecho-Slovakia. 302,338. September 7th, 1928; convention date, December 16th, 1927. In the production of citric acid by the fermentation of carbohydrates by mould fungi such as *Aspergillus niger*, the mould stock is cultivated in alternating stages including cultivation in solid media of the gelatine and agar-agar type, cultivation in liquid media under the conditions of industrial fermentation and cultivation on vegetable culture media (such as fruit pulp) containing organic acids and vitamins. The wash to be treated for the production of acid is such as would be used in an alcohol fermentation, nutrient substances being added in amount restricted to the minimum for the optimum conversion of sugar into acid, part of the nutritive nitrogen being in the form of organic compounds, in particular amino acids. Protective substances which mask the acidity of the citric acid are also added, these including albumens or their degradation products, non-fermentable carbohydrates of high molecular weight, etc., forming complexes with the citric acid of high molecular weight which are unable readily to penetrate the cells of the fungi. An example describes the fermentation with *Aspergillus niger* of a mask containing sugar, potassium biphosphate, magnesium sulphate and ammonium nitrate, the culture being prepared as above set forth. In a further example a mask prepared as in the foregoing example but without the ammoniun nitrate is treated with a similar culture with the addition of hydrolysed glue solution. A discussion of the prior art of the production of citric acid by fermentation is contained in the Specification.—ELECTRIC MEASUREMENTS. **H. S. Hatfield.** 282,170. September 20th, 1926. Apparatus for indicating the proportionate amount of a constituent in a liquid is arranged to record automatically any alteration in the electrical conductivity of the liquid due to chemical change or elimination of constituents. It is said to be suitable for obtaining indications in sugar manufacture and refining.—ROTARY DRYER. **K. Fraser** and **Fraser & Co., Ltd.** of Dagenham, Essex. 302,541. May 10th, 1928. A rotary drying cylinder having diametrical partitions arranged in staggered relationship in adjacent longitudinal sections of the cylinder is provided with partitions carrying members to agitate the material as it passes through the cylinder. The diametrical partitions may be secured to a hollow shaft having nozzles through which hot air or gas is introduced into the cylinder, and the partitions removably mounted within the cylinder. The cylinder may be jacketted, valve-controlled ports being arranged between the cylinder and the jacket space to permit hot air or gas passing from the jacket into the cylinder.—GLUCOSE PRODUCTION. **International Patents Developments Co.** (assignees of **C. Ebert, W. B. Newkirk,** and **M. Moskowitz.**) 303,142. October 1st, 1928; convention date, December 30th, 1927. The dextrose content of mother-liquors obtained in the conversion of starch into dextrose is increased by reducing the density of the liquor to about 14° Bé., increasing the acidity to about $pH = 1{\cdot}8$ and heating under pressure, the polysaccharides being reconverted into dextrose. (Specifications 227,140, 232,160, and 290,847 are referred to).

UNITED STATES.

CANE MILL INSTALLATION. **Franklin Farrel, Jr.** (assignor to the **Farrel-Birmingham Co.**, of Ansonia, Conn., U.S.A.). 1,691,546. November 13th, 1928.

A differential motion is produced between coacting cane crushing rolls or shredding rolls through the bite of which the cane passes, or between coacting rolls of a pair where such rolls have both a crushing and shredding action on the cane, for the purpose of shredding or disintegrating the stalks more thoroughly and expeditiously than in prior practice, which action is due in large part to the difference in the surface speed of the rolls acting on the cane at the respective sides of the stalk. In the mill shown in Fig. 1, is illustrated a preliminary crusher *A*, in front of a juice-expressing mill *B*. The crusher comprises a pair of toothed rolls 10, mounted in a stand or housing 11. There may be two or more pairs of preliminary crushing rolls, if desired, but it may be assumed that the cane from the field is delivered to the single pair of crushing rolls 10 by a suitable conveyor and chute (not shown). It is crushed by the rolls 10 and the stalks then pass to the mill *B*, consisting of rolls 12, 13 and 14. Rolls 10 are provided with a plurality of annular grooves 10^a which are substantially V-shaped in cross section, the provision of which creates correspondingly shaped ridges or ribs and the ribs of the upper crusher roll enter the grooves of the lower crusher roll with a certain amount of clearance, as is customary. In order to provide teeth for hooking into the cane stalks and drawing them into the machine, the preferred practice is to cut a plurality of generally longitudinal grooves 10^b in each crusher roll, intersecting the transverse, i.e., annular V-shaped grooves. While, however, these grooves 10^b are longitudinal in a general sense, they are preferably not exactly in line with the axis of the roll; in fact it is considered the best practice to provide an obtuse angle in each lengthwise groove, as shown in Fig. 2 for example. In



other words, a slightly inclined groove extending from one end of the roll to the centre, or thereabouts, meets at the latter point a similar groove, inclined in the opposite direction and extending to the other end of the roll. These grooves may be inclined at an angle of say 10° to the roll axis, as such an arrangement has given very good results in practice. With the purpose of increasing the crushing effect of the rolls, and particularly of the preliminary crushing rolls, and of augmenting the capacity of the machine, a differential motion of one roll relatively to its mate or coacting roll is provided. For obtaining these advantages, one roll rotates at a materially greater surface speed than the roll on the opposite side of the cane stalk, between which two rolls the cane passes, and by which rolls the cane is fed. The result is that the cane stalks are torn apart more thoroughly and more effectively shredded and opened up, so as to separate or permit the separation of the individual juice carrying fibres; and by shredding the cane in this manner the fibres are put in a condition in which they will readily give up their juice when they are subjected to the squeezing action of the following rolls. The provision of the different surface speeds in the respective rolls of a pair of cane grinding rolls, and particularly crushing rolls, is considered of special advantage to the case where the crushing rolls are provided with teeth, such for example as the crushing rolls 10 shown in Figs. 1 and 2; but if desired, this feature may be used also in connexion with juice expressing rolls, or in other words, the ordinary 3-roll mills that follow the preliminary crushing rolls, or it may be useful in connexion with a mill in which one or more rolls have a hooking or drawing-in action on the cane and a considerable juice-expressing action in addition. In the machine shown in Figs. 1 to 3 inclusive, the crusher rolls 10 of crusher *A*, are differentially driven, but in this particular case the rolls of the 3-roll mill *B* are all driven at substantially the same speed. While the differential drive which produces a friction motion on the cane is shown in connexion with crusher rolls having teeth, it is to be understood, however, that this feature may be utilized in certain cases where the rolls have no teeth, and in some cases where the rolls have no grooves, and in fact where the character of the roll surface is entirely different from that herein particularly described. It is desirable, however, that the rolls have a somewhat roughened surface, because otherwise they cannot grip the cane stalk which is especially slippery as a result of the fact that the cane becomes covered with the slippery juice as soon as it enters the machine. The teeth of the preliminary crusher are especially desirable for the prevention of the slippage of the roll surface on the wet and slippery mass of cane, inasmuch as they provide a means for penetrating the stalks or at any rate of gripping them so effectively that the feed of the cane into the machine will not be arrested, which might otherwise be the case. In the embodiment shown in Figs. 1 to 3 inclusive, the top roll 12 is provided with lengthwise grooves similar in character to those of the preliminary crushing rolls. These grooves of roll 12 are for the purpose of improving the feed of the cane into the mill *B*, and in this case the toothing of the roll has advantages similar to those pointed out above. It will be understood, of course, that the action of the rolls 12 and 13, that is to say, the action produced by their co-ordination, is the feeding of the cane into the 3-roll mill, which is inproved materially by the lengthwise grooving of the top roll. The greatest crushing effect occurs between the top roll and the bagasse roll. The annular ribs of these two rolls are usually in staggered relation and so arranged that the annular rib of one roll extends within a groove of the other, although a suitable clearance is always provided, such clearance being determined with respect to the squeezing or pressure which it is desired to exert. It will be understood that where the top roll 12 is provided with the longitudinal grooves its squeezing surface is somewhat diminished, but in the case under discussion the number of lengthwise grooves in roll 12 is considerably less than that of the lengthwise grooves in the preliminary crusher, so that while the available co-operating squeezing surfaces of the top roll 12 and bagasse roll 14 are not materially decreased, the feeding action of rolls 12 and 13 on the other hand is quite noticeably increased and improved. Referring now to the difference in the surface speed of the coacting cane grinding rolls, and more especially the different surface speed of the preliminary crushing rolls 10, above described, it may be said that in the machine shown in Figs. 1 to 3, the top crusher roll 10 is driven at a speed approximately 13 per cent.

slower than the coacting upper roll. This arrangement, while preferred, is merely illustrative, however, as the upper roll may be the faster one. The differential motion may be readily obtained by proper toothing of the driving gears, and in this connexion it may be explained that in the machine now under discussion, the gear 16, by which the upper roll 10 is driven, has a somewhat larger number of teeth than its coacting gear 17. The lower roll 10 is of the same diameter as the upper roll and is driven in the ordinary manner by a shaft 18, on which gear 17 is mounted, the gear 16 on the shaft of the upper roll meshing with the said gear 17, as in ordinary practice ; but the arrangement under discussion differs from ordinary practice in providing for a different surface speed of the rolls through the dissimilar number of teeth on the driving gears, which in this particular case causes one roll to be driven at least 13 per cent. faster than the other under all conditions, but the inventor is not limited to any specific difference in the surface speed of the coacting rolls. The mill *B* is driven from a shaft 19, connected with or carrying the roll 12, and a gear 20 on said shaft meshes with a gear 21 on the shaft of cane roll 13, and with a gear 22 on the shaft of bagasse roll 14. If it be desired to produce a differential action, as between any two of the rolls of the 3-roll mill *B* (all of which rolls are in this case of substantially the same diameter), the intermeshing gears will have a dissimilar number of teeth, as above described, in connexion with the preliminary crushing rolls. The longitudinal grooving of the top roll of mill *B* has been found very advantageous in actual practice in cases where such mill, or its equivalent, is followed by a plurality of similar 3-roll mills, all of the mills being arranged in tandem in the well-known manner. In such a case the first mill, or more particularly the top roll thereof, has to a certain extent the function of a crusher, owing to the crushing or shredding action that is produced by the provision of teeth on the roll ; so that in many cases a single pair of preliminary crushing rolls will suffice on an installation of this character ; although at the same time the first 3-roll mill retains its character as a means for exerting high pressure on the cane passed through it, as above described, so as to force out a large quantity of juice, which runs off in the roll grooves and is then disposed of in the usual way. A further modification in such a mill is also described.

IMPROVEMENTS IN MAKING STARCH AND GLUCOSE. **Charles R. Brown and Hubert E. Nelson**, of Keokuk, Iowa, U.S.A. 1,690,360. November 6th, 1928. The process for removing substantially insoluble iron salts from starchy materials comprises treating them with a dilute acid solution of low concentration but having an acidity comparable to hydrochloric acid whereby the insoluble iron salts are converted into soluble iron salts, and then washing the starchy materials to remove therefrom the solubilized iron salts and the residual acid.—PLASTIC FROM ARTICHOKES. **Edwin K. O'Brien**, of Charlottesville, Va., U.S.A. 1,690,648. November 6th, 1928. As a new article of manufacture, a preparation is claimed comprising portions of the plant known as the Jerusalem artichoke dried and reduced to a finely divided condition, mixed with substances adapted to render the whole resistant to deterioration effects of heat and moisture.—CANE CRUSHER AND SHREDDER.[1] **Francis Maxwell**, of Wallington, Surrey. 1,690,828. November 6th, 1928. Claim No. 1 of this specification reads as follows : In combination in apparatus for crushing and shredding sugar cane or the like, a pair of co-operating crushing rolls, means for applying and adjusting the pressure between said rolls, co-operating crushing teeth on the surface of said rolls, and a shredder roll disposed at the delivery side of said crushing rolls and adjacent to one of said crushing rolls to co-operate therewith in shredding the cane, and means for regulating and controlling the pressure between said shredder and co-operating crushing roll.—ROTARY FILTER. **Arthur Wright**, of Upper Montclair, and **Frank W. Young**, of Verona, N.J., U.S.A. 1,691,950. November 20th, 1928. The process of treating a filter-cake formed on the filtering medium of a rotary drum filter, which comprises overlaying the cake on the filtering medium with a compression member and thereby compressing the cake, moving the compression member with the cake by its contact therewith, and then separating the compression member and filtering medium and stripping the cake from the filtering medium.—CITRIC ACID. **Auguste Fernbach**, of Paris, and **John L. Yuill**, of York (assignors to

[1] See U.K. Patent, 198,120, dated March 14th, 1922.

Rowntree & Co., Ltd., of York). (*A*) 1,691,965. (*B*) 1,691,966. November 20th, 1928. These processes for the production of citric acid from solutions of cane sugar containing the necessary nutrient materials by means of fungi comprise adding to the solution hydrochloric acid in quantity sufficient to raise the hydrogen ion concentration to a point lying within the range $pH = 1{\cdot}2$ to $pH = 2{\cdot}5$, whereby sterilization by heat is unnecessary.—SCALE CLEANER. **Knut H. V. Gustafsson,** of Gottenborg, Sweden. 1,692,500. November 20th, 1928. A rotary rust or scale cleaner for internal cleaning of boiler and like tubes includes rotatable shaft, a chipping member eccentrically mounted at the free end of said shaft guide,means for said shaft located at a substantial distance from the chipping member whereby the axis of the journalled portion of said shaft is held in position in the centre of the tube under treatment to prevent displacement across the interior of the tube.—CLARIFYING CORN SUGAR LIQUORS. **Clarence H. Christman,** of Chicago, Ill., U.S.A. 1,692,817. November 27th, 1928. Solutions of hydrolysed carbohydrates are purified and clarified by neutralizing them with a reagent comprizing sodium aluminate.—CRYSTALLINE DEXTROSE. **Wm. B. Newkirk,** of Riverside, Ill., (assignor to **International Patents Development Co.,** of Wilmington, Del., U.S.A.). 1,693,118. November 27th, 1928. Claim is made as a material of manufacture for crystalline anhydrous dextrose in the form of granules, the majority of which are individual crystals having smooth faces. —BEET TOPPER. **Oswald H. Hansen,** (assignor to **Hansen Canning Machinery Corporation,** of Cedarburg, Wis., U.S.A.). 1,696,398. December 25th, 1929. Claim is made in combination for a pair of rotary rolls having co-operating surfaces formed to remove appendages from objects travelling therealong, gears associated with the upper ends of said rolls for rotating the same, a housing enclosing said gears, sealing means for preventing ingress of juice to and egress of lubricant from within said housing along said roll surfaces, and means for delivering said objects upon said rolls below said sealing means.—CANE HARVESTER. **Albert J. Buquet,** of Kahns, La., U.S.A. 1,698,670. January 8th, 1929. Claim 1 is for :—A cane harvester comprising a wheeled frame, spaced side stiles including substantially horizontal portions and diagonal portions extending from the forward ends of the horizontal portions downwardly to a point in front of the vehicle and close to the ground, means on the vehicle for supporting the stile bars at an elevation above said vehicle, cutting means for the stalks extending across the forward portion of the stile bars, gathering means also carried by the lower portions of the stile bars for acting on the stalks above the cutting means and moving said stalks down to a position lengthwise of the vehicle and with the tops of the stalks extending rearwardly of the vehicle, upper and lower endless conveyors carried between the diagonal portions of the stile bars with the lower conveyor extending forwardly of the upper conveyor and the upper conveyor extending rearwardly of the lower conveyor, rotary stripping means located between the stile bars adjacent the space between the upper ends of the conveyors, said rotary conveyor having its upper stripping portion moving forwardly, a number of spirally grooved rolls mounted with their axles transversely disposed in the horizontal portions of the stile bars rearwardly of said stripping means, means for driving said rolls, a table supported by one of the stile bars adjacent said rolls for receiving the transversely moving stalks therefrom, and topping means at the rear portion of the table.—FILTER-CAKE DISCHARGING APPARATUS. **Jasper A. McCaskell,** of Salt Lake City, Utah, U.S.A. 1,700,772. February 5th, 1929. In a continuous filter is provided a filter agent arranged to dip periodically into and to rise from the material being filtered and means for producing a rapid back and forth bending movement of the surfaces of the filter agent during a portion of its travel when it is out of the material being filtered.- -BEET LOADER. **Roy Coon,** of Windsor, Colo. 1,700,922. February 5th, 1929. A beet loader comprises, in combination, a framework, a conveyor secured to and extending transversely of the framework, a plurality of spaced teeth secured to the framework and extending longitudinally thereof, said teeth being adapted to gather and support material, a shaft rotatably connected with the frame, means for rotating the shaft, means carried by the shaft for raising the material from the fingers and depositing it in the conveyor, said last-named means comprising a plurality of S-shaped teeth, and means for reciprocating the shaft as it rotates.

UNITED KINGDOM.—Figures of Imports and Consumption for the past Three Years and for 1913.

(From CZARNIKOW'S *Weekly Price Current*).

REFINED—	1928. Tons.	1927. Tons.	1926. Tons.	1913. Tons.
Czecho-Slovakia	100,425	133,080	316,430	*198,064
Holland	88,101	185,546	236,575	178,567
Belgium	3,818	9,325	15,282	49,764
Germany	1,080	20,769	30,440	465,453
Poland	3,833	5,734	11,693	—
France	32	—	450	26,570
Italy	—	—	839	—
Hungary	—	27	—	—
U.S.	15,231	42,885	12,028	385
Canada	6,169	52,475	65,950	—
Natal	—	229	6,435	—
Cuba	62	6,709	300	—
Others	2,994	11,937	2,527	3,742
Total Refined	221,745	468,716	698,949	922,545
Entered for Consumption	219,628	522,312	696,348	899,327
U.K. REFINED—				
Entered for Consumption	336,423	880,040	788,022	715,661

* Austria-Hungary.

RAWS—	1928. Tons.	1927. Tons.	1926. Tons.	1913. Tons.
Poland	22,813	6,454	13,573	—
Germany	460	4,320	13,668	472,026
Czecho-Slovakia	21,282	1,208	342	*160,858
Austria	—	—	—	—
Hungary	85	190	—	—
Russia	6,388	—	—	—
Holland	10,669	—	—	—
Cuba	715,526	356,146	272,494	224,227
San Domingo	208,359	137,767	106,957	9,412
Peru	99,933	133,518	123,140	27,487
Java	8,092	10,264	53	99
Brazil	18,000	40,543	6,750	5,133
Venezuela	3,309	4,763	2,228	—
Honduras	12,395	10,051	—	—
Argentine	14,097	38,934	—	—
Mozambique	—	6,655	564	—
Mexico	—	3,333	2,265	4,134
Hayti	4,657	—	4,289	—
Dutch Guiana	4,402	2,849	3,512	4.606
British India	255	100	—	3,850
Mauritius	188,675	192,565	201,933	20,075
B.W.I.	138,620	92,296	98,858	47,736
Natal	71,440	43,887	57,975	—
Australia	150,604	83,328	151,285	—
Others	10,114	7,747	6,242	67,072
Total Raws	1,710,175	1,176,918	1,066,128	1,046,715
Entered for Consum'n	1,239,657	138,648	143,959	116,942
Total Imports Raw and Refined	1,931,920	1,645,634	1,765,077	1,969,260

Home-grown Sugars are not included in above figures.

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to Feb. 23rd	467,152	..	446,717
Deliveries „ „	468,037	..	402,018
Meltings by Refiners „ „	375,225	..	359,800
Exports of Refined „ „	12,000	..	8,012
Importers' Stocks, Feb. 23rd	97,346	..	153,239
Total Stocks, Feb. 23rd	254,882	..	247,203
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT JANUARY 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	152,914	..	29,992	..	229,914
Stocks	298,683	..	109,190	..	457,157
	451,597		139,182	..	687,071
Local Consumption..	6,000	..	1,087	..	10,619
Receipts at Ports to November 30th ..	457,597	..	140,269	..	697,690

Habana, January 31*st*, 1929. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(*Willett & Gray's Estimates to February* 14*th*, 1929.)

	1928-29. Tons.		1927-28. Tons.		1926-27. Tons.
CANE.					
America	8,893,229	....	8,162,400	....	8,610,169
Asia	7,061,164	....	6,890,686	....	6,322,240
Australasia	638,000	....	588,163	....	484,682
Africa	694,695	....	651,330	....	600,997
Europe	——	....	9,000	....	6,719
Total Cane	17,287,088	....	16,301,579	....	16,024,807
BEET.					
Europe	8,315,000	....	8,031,874	....	6,871,892
U.S.A.	949,000	....	965,241	....	801,246
Canada..............	33,000	....	27,212	....	31,422
Total Beet	9,297,000	....	9,024,327	....	7,704,560
TOTAL CANE AND BEET....	26,584,088		25,325,906		23,729,367

United Kingdom Monthly Sugar Report.

Our last report was dated February 8th, 1929.

The general conditions of the market all over the world have taken a turn for the better, and the easier tendency which prevailed for so long has disappeared. A steadier tone is apparent both for Raw and Refined.

The White Terminal Market has continued in a restricted manner, and the transactions are not numerous. The interest seems to be transferred to the Raw Terminal Market, on which it is much easier to operate. March White remained round about 12s. until the last few days, when on the tenders, about 8500 tons being taken up, the market rapidly improved up to 12s. 7½d. May has been sold up to 12s. and August to 12s. 6d., January 1930 at 12s. 8¼d. and March 1930 at 12s. 9d. to 12s. 9¾d.

The Raw Terminal Market has, this last month, shown much heavier registrations, March sold from 8s. 9d. to 8s. 6d., but has since improved again to 8s. 9d., May fell from 8s. 11¼d. to 8s. 8¼d. but subsequently improved to 9s. August sold from 9s. 3d. to 9s. 1½d., but this month has likewise improved to 9s. 6d., while December improved from 9s. 4½d. to 9s. 8¼d. The latest prices are :—

	MARCH			MAY			AUGUST			DECEMBER	
	s.	d.		s.	d.		s.	d.		s.	d.
White	12	6	..	11	9¾	..	12	1½	..	12	5¼
Raw	8	9	..	8	10½	..	9	4½	..	9	6¾

Dealings in actual sugar started for the first few weeks under review in a very dull tone, and trading was very slow, but recently there has been more confidence and a fairly large business has been done in Home Grown and British Refined at advancing prices. The Refiners made two advances. 3d. per cwt. on the 27th February and 3d. per cwt. on the 7th March, their latest prices being No. 1 Cubes 26s. 3d., London Granulated 23s. 4½d. Prices for Home Grown have moved in conformity with British Refined and the latest prices are 22s. 3d. to 22s. 10½d. according to factory.

Continental Dutch Granulated has been sold down to 11s. 6d. but owing to the cold weather on the Continent Czecho Granulated has only been offered for reopening. The latest price is 11s. 4½d., whilst May/August is offered at 11s. 6d. and November/December at 11s. 7½d.

Raws have been steady and Cubans were sold down to 9s. 3d. Perus afloat sold at 9s. 0¾d. The latest price for the latter is 9s. 5¼d. and Cubans cannot be bought under 9s. 7½d.

The American Market was easier and Raws fell at one time to $1\frac{15}{16}$ but the latest price is 2 cents, at which a fair business has been done. The Futures market is steady and has recovered five or six points.

There is no further news with regard to Europe and F. O. Licht has made no change in his estimate.

The Cuban production to date is 2,500,000 against 2,040,000 tons last year, but the exports to date have been nearly 400,000 tons more than last year, so that the stock in the island is only about 50,000 tons above last year.

21, Mincing Lane,
London, E.C.3.
11th March, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 364. APRIL, 1929. VOL. XXXI.

Notes and Comments.

The Outlook.

The world sugar market remains dull and the hoped-for improvement will at best materialize only slowly. Refiners both in America and in the United Kingdom are only buying from week to week, and the latter are well stocked. Indeed they were too well stocked for their own warehouse accommodation a few weeks ago; and to reduce the excess they disposed of a certain quantity, said to be 40,000 tons of refined sugar, to the East at comparatively low prices—10s. 9d. f.o.b. London according to the *Times*—rather than incur the cost of other warehouse space. Guma & Mejer in the middle of March quite unexpectedly issued a forecast of the present Cuban crop which took the market by surprise; they placed the probable production as high as 5,218,428 long tons. This is a good deal more than the previous expectations of about 4¾ million tons, and is higher than the Cuba Club's simultaneous estimate of 5,064,150 tons. On the market it naturally had a bearish effect, though with prices what they are no marked fluctuations can result from adverse influences. But prices drooped once more to the lowest of the year. Cuba of course has abandoned official restrictions of the crop; but some form or other of private combination to control export, especially to countries other than the States, has been devised and put into force. There is also a movement on foot to induce the American Government to allow a portion of the Cuban crop entering the States to receive preferential treatment, while the rest is subjected to the present tariff impost. This suggestion is being considered in Washington; but meantime Congress is due to meet on April 16th for a special session, when amongst other items the sugar tariff question willl come up for consideration, and the domestic interests will doubtless make out their case for increasing the tariff against all foreign sources.

Doubt is expressed in more than one authoritative quarter as to whether Cuba is at all likely to produce so high a figure as Guma has forecasted. Something much nearer the five-million ton mark is considered as much as Cuba can accomplish; however, it is to be noted that Cuban production to March 16th is put at 3,275,000 tons, as compared with 2,725,000 tons on the same date in 1928. Meantime from Java a preliminary forecast of the 1929 crop has been forthcoming, which places the probable production at about 3,030,000 tons, as compared with about 2,945,000 tons last season.

At home we are awaiting the details of Mr. CHURCHILL's last Budget before the dissolution of Parliament and the General Elections in the summer. A popular touch to the Budget has its uses on the eve of an election, and it will not be surprising if there is remission of certain taxes which may include some of the "breakfast table" items. But tea is supposed to be a better draw for that purpose than sugar; and probably if sugar receives any favours these will be destined more with a view to assisting Empire sugar over a difficult period than in actually lowering the tax on the consumer.

Britain's Sugar Supply.

The Sugar Federation of the British Empire has lately issued a pamphlet discussing the vital Imperial problem of Britain's sugar supply, such as should serve a useful purpose on the eve of the coming General Election. Sir BENJAMIN MORGAN, who contributes the Preface, points out that ten years after the war starvation period Great Britain is still dependent on foreign countries for two-thirds of her sugar imports. And with the dominance of these foreign suppliers goes also the control of price. On the other hand, he reminds us that the sugar we purchase in those foreign countries employs practically no British manufactures in its production, whereas our Empire sugar utilizes principally British machinery and supplies. This fact alone should justify a special effort to get all our supplies from Empire sources. Parenthetically, we may remark that there was a time, some decades ago, when Cuba bought an appreciable proportion of her sugar machinery requirements from the United Kingdom; but since the present American ascendancy in Cuba was established, the steady diversion of this trade to the United States manufacturers has been a noticeable feature. Now that both Cuba and San Domingo send such large supplies of their sugars to this country, it seems permissible to enquire what exports there are to pay for these greatly augmented imports of ours.

Sir BENJAMIN also reminds us that our Empire sugar industry has necessarily had to be built up in small and scattered units all over the world; and thus it has never had the advantage of operation in large and compact economic units such as our competitors enjoy. Yet if it could consistently regard Great Britain as its Home market with the usual preferential advantages attached to the obligation, the scattered Empire units could without question not only rival but beat our competitors in economical production.

The main part of the pamphlet gives a brief but succinct account of the principal features that mark out the several sugar producing centres of the British Empire. Australia, we are told, could increase considerably the amount at present exported to this country (200,000 tons this year), if there were a substantial increase in the preference. The ultimate sugar productive capacity of Natal and Zululand can be taken to be at least four times the present output of South Africa. Mauritius used to have valuable markets in South Africa, Australia, and India. But the two former have since developed their own production, and India gives no preference to Empire sugar, so the United Kingdom remains almost the only market open to the Colony. It has been suggested before now that British East Africa offers Mauritius a new field for marketing her sugar; but as we show in a Note below the inauguration of sugar cultivation in Kenya has had such favourable results, that it seems only a question of time ere the pioneer experiment is expanded into an industry that will supply the needs of our East African mainland territories, to the virtual exclusion of imported sugar.

The Present Position of West Indian Sugar.

A Barbados correspondent of *The Times* recently discussed the position of the British West Indian sugar industry under the influence of the present low prices. The importance of this industry to the islands may differ but nowhere is it small; and to Barbados it is vital, the whole economic fabric of this colony being made up of sugar, and no other crop will support such a density of population, unless perhaps sea island cotton. So Barbados can afford to leave nothing undone that might help the industry to support itself.

How far, then, has the planter helped himself and how much could yet be done? It can be said at once, remarks this writer, that in the sugar industry, as in all others, there are people who are content with antiquated machinery and inefficient methods. There are still far too many small factories in Barbados each dealing comparatively inadequately—and expensively—with limited areas, although the large factory serving an extensive area has long since proved successful. If it were these people alone who suffered, the remedy would lie in their own hands. But even the most progressive and enterprising of the planters are producing at a loss.

Rightly or wrongly, the planter feels that the alteration of the sugar duties in the 1928 Budget has, so far from helping him, brought ruin in its train. The effect of the duties has been to force the foreign producer to throw his sugar on the British market as raws, and since the British West Indies produce nearly all their sugar under this description, upon them, it is argued, has fallen all the intensity of foreign competition. It is in fact claimed that the British refiner has at once been exempted from foreign competition and reaped a considerable advantage at the expense of the West Indian grower. Such at any rate is the argument. Various remedies are suggested; but all involve altering the incidence of the sugar duties further in favour of the West Indian and other colonies. If it is suggested that the British taxpayer would be left to foot the bill, then the answer is that since help of some sort seems inevitable it is only a question of the best form in which that help can be given; and between a non-productive dole and the reinforcement of a hard-hit industry the choice should not be hard to make.

As it is, the 1929 Budget which will be disclosed this month by Mr. CHURCHILL is credited with an intention to give some further assistance to the Empire sugar industry; but Budget rumours must be taken with reserve, and there has not this year, as was the case in 1928, been a virtual *secret de Polichinelle* about the sugar duty changes.

The Economic Position of the Coimbatore Seedlings in Bihar.

The Coimbatore seedlings are gradually creeping into the literature of countries in the tropics. They were designed to replace the inferior kinds of cane grown in North India, where the climate alternates between a warm temperate one (with occasional frosts in places) and a tropical one with very great heat at times—roughly six months of each. The first two or three months of summer are extremely hot and dry, so that the actual growth of the cane is relegated to the second half of this period when the rains are torrential: ripening follows when the rains cease and the air becomes drier and colder. The canes have thus practically only four months or even less for the cane forming period of their growth, and one to two months to ripen in, and considering these handicaps it is a matter of wonder what they can do in the time. For such canes to be grown in tropical countries with a twelve month growing period is anomalous; and their replacement of hundred per cent. tropical canes shows that something is very radically wrong. This has always been

our view, and we have never encouraged the introduction of the Coimbatore seedlings of other north Indian canes into the tropics.

They have apparently served the purpose for which they were produced; and, after due testing, are spreading rapidly in the north Indian tract, where between two and three million acres are under cane. They were obtained by crossing tropical canes with the hardier and better local kinds, and in a few cases with the wild *Saccharum spontaneum* (e.g. Co 205); with the result that the new seedlings gave an increased tonnage, even under adverse conditions of drought and excessive moisture. Such adaptability was obviously a matter connected with the root system, and T. S. Venkatraman has very thoroughly studied this part of these seedlings. But, in the nature of the case, the Coimbatore seedlings have their faults, when instead of being grown for gur making by the cultivators, they are grown for making sugar in modern factories. Their value for the series of European sugar factories which sprang up in Bihar, after indigo had been driven out by the synthetic product, was primarily demonstrated by Wynne Sayer, the Secretary of the Sugar Bureau; and it was stated before the recent Royal Commission on Indian Agriculture that they had saved the industry in Bihar. And now, after years of close study of their behaviour in the ryots' fields and in the European factories, he has submitted the standard seedlings of the tract to a careful economic criticism; indicated their virtues and faults and suggested the lines along which the cane breeder should work to put both the factory and the cultivator in a better and more stable position. We have therefore printed this long article in full on another page, not only because of its local application, but also for the benefit of those countries which appear to have interested themselves in these seedlings.

Sugar Producing Possibilities in East Africa.

We print on another page a summary note on the important development which is taking place in the manufacture of white sugar and motor spirit in Uganda, including the total cost of producing a ton of sugar cane, ready cut and loaded for the factory, both by hand labour and by mechanical tillage. The details of these latter are drawn from the single modern plantation at Lugazi on the border of the Victoria Nyanza, which to all appearance is in a very satisfactory position, untroubled by freights and fiscal difficulties, because of an expanding market secure from competition in the heart of Africa. The methods adopted in growing the canes are not, as might be expected, stereotyped or slipshod; but show a keen appreciation of good and careful cultivation from the start. The yields appear to be very large, and a ruling principle all through is the careful turning in of the mountainous mass of trash, in the hope that the inevitable deterioration of the soil under long continued cultivation will be successfully delayed for a generation at least—therefore no artificial manure is at present required. The writers of the pamphlet referred to elsewhere have had in some respects an easy task, in that, although the industry has its problems, there is a marked absence of the complications which would occur where a number of separate plantations are concerned, with different soils and environments, and very different economic factors to contend with. It is satisfactory to reflect that, in at least one part of our sadly harassed tropical sugar industry, the present low prices are a matter of little concern; and that, in spite of this, no laissez faire attitude is allowed, but every detail of the plantation work for the growth of healthy canes is carefully attended to—such is the impression conveyed on reading through the account which has just reached us.

Notes and Comments.

Java.

The last Department of Overseas Trade Report on Economic Conditions in Java, in speaking of the trade in machinery generally, remarks that British suppliers, who have in the past enjoyed a steady trade with that country and regularly received repeat orders, have been enquiring why, without any apparent cause, their sales have more recently been falling off. One reason is that Continental manufacturers are offering at lower prices machinery which is very similar in design to British standards, though often the lower prices quoted by these competitors are more apparent than real, and only possible because certain accessory parts usually supplied with British machines, and which are not necessarily an integral part of the machine itself, are not included in the Continental prices. As customers make a closer study of prices than of specifications, the tendency is for them to buy what appears to be the cheapest offer.

Imports of sugar machinery into Java from January to August 1928 were in round figures valued at £650,000, of which £450,000 came from Holland, £100,000 from Germany, and £60,000 from the United Kingdom. Dutch engineering firms have obtained a very strong hold on the Java sugar industry; but here it is suggested Great Britain might improve her sales by strengthening her local representation.

Dealing with the decision of the Associated Mills ("V.J.P.") to dispose of the 1928 crop as expeditiously as they could, even at a reduced price, the same Report states that the impression is gained that the associated mills, in order to avoid sales under pressure, were not anxious to accept the alternative of storing the unsold portion of their 1928 crop. Such an alternative would have been without precedent, since neither before nor after the war have they ever found themselves in such a predicament. The lower prices accepted by the V.J.P. for deliveries west of Suez should therefore perhaps be regarded as a compromise between a general reduction in price in order to sell out as rapidly as possible and the storing of several hundred thousand tons of the 1928 crop for gradual sale at limit prices to all destinations.

Sugar Beet Investigations, 1929.

For the third year in succession the Ministry of Agriculture and Fisheries, in co-operation with the Beet Sugar Factories' Committee of Great Britain, is carrying out in various parts of England and Wales, with the assistance of Agricultural Institutes, County Agricultural Organizers and experienced growers, experiments with a view to encouraging a higher standard of cultivation and a higher yield of beet per acre, the necessary funds having been supplied by the beet sugar factories. The experience of the first two years, which has been carefully codified and examined, has resulted in the division of the scheme this year into two parts, namely, Investigations and Demonstrations.

The Investigations comprise: (1) the continuance of the intensive seed variety trials conducted under the aegis of the National Institute of Agricultural Botany, Cambridge; (2) further trials in the use of labour-saving agricultural implements under the guidance of the Institute of Agricultural Engineering, Oxford; (3) a further series of carefully controlled investigations concentrated on certain points connected with the spacing of plants and manuring, on which further information is still required.

The demonstrations are designed to illustrate the fact that the securing of good beet yields requires careful attention on the part of the grower to

recognise good principles of cultivation. Under the scheme approximately 150 growers distributed throughout England and Wales will be asked to act as demonstrators and to conform in broad outline to rules of cultivation, etc., laid down by the Beet Sugar Factories' Committee in consultation with the Ministry. Flat rate grants on an acreage basis will be paid to the demonstrators, and an additional grant in each of the main areas will be paid to the demonstrator who secures the highest sugar yield per acre, taking into account the cleanliness of cultivation and the class of land on which his crop has been grown.

The American Sugar Refining Company: Annual Report.

During 1928 the American Sugar Refining Company refined 1,217,336 long tons of raw sugar, at a profit of $8,016,436, or of about a quarter of a cent. per lb. after providing for taxation but before depreciation. This compares with a profit of three millions odd in 1927, seven millions in 1926, four and a half millions in 1925, and a loss in 1924 of $327,637. The meltings have, however, been the lowest of the last four years, those of 1927 being 1,301,670 tons and those of 1926 1,374,350 tons. The sum of $1,750,000 has been set aside for depreciation, of which $1,250,000 has been charged against income and the rest against sundry reserves. The rebuilt Brooklyn refinery completed its first fiscal year with gratifying results. And during the year extensive replacements were also completed at other plants, the sum of $1,276,635 having been spent on improvements throughout the Company's properties.

Mr. BABST remarks that the sugar industry continues to face uncertain conditions. It continues to be affected by its war effort. With present low prices, however, it is reasonable to expect a halt in the rapid growth of production and an increase in consumption. Should there be no further Governmental interferences, there is reason to expect a healthy slow recovery of the industry in all its branches commensurate with the increase in consumption. As for the "American," it is in a better position than for many years to share in an improvement in the industry; its goodwill with the distributing trade and with the consuming public has never been more secure, and its package business was larger in 1928 than in any previous year.

League of Nations Sugar Committees.

The meeting of experts of the sugar industry which the Economic Committee of the League of Nations decided to convene at its session in January last was fixed for the 4th of this month. The experts are representative of at least seventeen countries; and amongst them are included: For Cuba, M. L. M. PEREZ (Secretary of State); France, M. HERSCHER (President of the Comité Central des Fabricants de Sucre); Germany, Herr RABBETHGE (Director of Rabbethge & Giesecke, Kleinwanzleben); Great Britain, Mr. H. A. FORSTER (of Messrs. C. Czarnikow, Ltd.); Dutch Indies, Dr. H. C. PRINSEN GEERLIGS. The name of the United States expert was not known when the list was sent out in the middle of March, but that country will of course be represented at the meeting.

NEW BEET ACREAGE IN U.K.—The Beet Sugar Factories Committee in this country report that the area already contracted to be devoted to sugar beet this year in England and Wales is 231,749 acres, being 56,013 acres in excess of last year, or an increase of 32 per cent. This acreage constitutes a record in the history of the British beet sugar industry.

The Late F. S. Earle.

A noted American sugar cane technologist has just passed away in the person of Mr. FRANKLIN S. EARLE, who succumbed to pneumonia at his home in Herradura, Cuba, on January 31st, just on the eve of undertaking the rôle of Chairman of the Committee on Cultivation of the 1929 International Technologists' Conference, for which meeting he was collecting some interesting reports from various parts of the world.

Mr. EARLE, who was born as far back as 1856, was associated in his earlier days with experimental agriculture on the U.S. mainland, and as a consequence of this experience published in 1908 an excellent book on "Southern Agriculture" which deserved a better reception than it appears to have received. Later on he undertook missions to Porto Rico and Cuba on behalf of the U.S. Department of Agriculture, which started him on that study of the cane which was to be his main interest thereafter. He was director of the Cuban Agricultural Experiment Station for two years and then acted as a consulting technologist for some years in Cuba. In 1918 he was sent by the U.S. Department of Agriculture to Porto Rico to help to tackle the mosaic problem. Here he was attached to the Insular Experiment Station and was listed as Plant Breeder in 1919, Expert in Plant Diseases in 1920, and later on Expert in Cane Diseases. In 1922 he retired from this task and became consultant for estates, first in Porto Rico and then later in Cuba, where he finally settled down as a consulting sugar cane technologist.

EARLE accomplished an enormous amount of useful work, especially in Porto Rico and Cuba, and his work was always of the first water; but he was a most retiring man, happy if people would let him alone to accomplish his tasks; he was therefore more in the background than his achievements warranted. Amongst these may be cited his successful fight against mosaic; and his wonderful annotated list of cane varieties. Besides the book above mentioned, EARLE published on the eve of his death a work entitled "Cane Sugar and its Culture" which had originally appeared in serial form in an American sugar periodical. This we hope to notice in an early issue.

SOIL ANALYSIS.—A noteworthy paper by the late George Newlands,[1] of the North of Scotland College of Agriculture, Aberdeen, was recently published showing well the results to be obtained by modern methods of soil analysis and their bearing on beet cultivation. Field conditions and mechanical composition did not account for certain variations observed in the growth of beet; but there was a certain correlation between it and the *pH* value and the readily extractable calcium content. In general when the *pH* was below 5·3 and the extractable calcium below 0·12 per cent., growth was poor or failed altogether. Between 5·3 and 6·2 *pH* growth was relatively good. In the case of soils of the same type the results for *pH* value, lime requirement, exchangeable calcium, titratable acidity, and degree of saturation all correlated well with each other and with the growth of the beet.

1 *Journal of Agricultural Science*, 1928, 18, Part IV, 704-712; also *Scottish Journal of Agriculture*, 1928, 11, No. 4 (reprinted by H.M. Stationery Office).

The Original Home of the Sugar Cane.

BY NOËL DEERR.

Since DE CANDOLLE in his "Origines des Plantes Cultivées" ascribed the home of the sugar cane to the Ganges valley[1] his opinion has been quoted in many publications. The present writer in 1911 suggested that the principal cultivated varieties of the cane and the Ukh canes of India were distinct species, and that the former, the noble canes of Java writers, had originated east of WALLACE'S line.[2]

Since then much research work has been done. BARBER[3] has studied and classified the canes of India, and if I interpret him correctly he inclines to the view that these canes have developed asexually from *Saccharum spontaneum*. On the other hand the cytological work of BREMER[4] seems to point to these canes being hybrids in various degrees between *Saccharum officinarum* and *S. spontaneum*. Of BARBER'S classes the Saretha group containing Chunnee and the Pansahi group containing Uba and Chinia have been classed by JESWIET[5] as *S. Barberi* and *S. sinense* (Roxburgh emend. Jeswiet) respectively.

Accepting that these canes are hybrids and the work of BREMER seems very definite, there must have been present in the Ganges valley at some remote period both *S. officinarum* and *S. spontaneum*. The latter is wild in that area but the former is not, and the following hypothesis is put forward to account for the hybrids.

Saccharum officinarum occurs in abundance in New Guinea and in the neighbouring islands. There also occurs there an insect *Rhabdocnemis (Sphenophorus) obscurus*, the beetle borer. This beetle is parasitized by a tachinid fly, *Ceromasia sphenophori*. These three, plant, pest and parasite are mutually connected. The pest is so highly specialized as to be unable to live without the sugar cane and in its turn the pest is necessary for the life cycle of the parasite. For so high a degree of specialization to have developed must have required many years of evolution.[6] In other words the sugar cane must have been domiciled here for many years and is therefore indigenous to those regions. The passage of *S. officinarum* to India requires explanation. In 1911 the Austrian philologist PATER SCHMIDT announced his discovery that the Mon Khmer dialects of India were connected with the South Pacific languages of which Hawaiian, Maori and Otaheitan are examples. Without falling into the error of presuming race identity from alliance of language in these cases, the identity of language seems to predicate a definite ethnic connexion between the Pre-Aryan peoples of India and those of the South Pacific. The writer would then suggest as an hypothesis that at some remote period there was a northward race migration from these regions to India and that the noble sugar canes accompanied the migrants. After they had settled in the Ganges valley hybrid canes adventitiously appeared. It was observed by some intelligent settler that these were more suited to the climatic conditions than were the canes that had been imported and these eventually disappeared.

This hypothesis of a northward migration is opposed to the accepted ideas of ethnologists who almost invariably treat of India and the East as a centre whence migrations started. Indeed some classifications consider the Polynesians as an early offshoot of the Aryan.

---

[1] See Note "A" on page 185.
[2] *Cane Sugar*. (First Edition), p. 43.
[3] Mem. Dept. Agric. India., VII, 1, IX, 4. But see Note "B" on page 185.
[4] Genetica, V, pp. 97, 273, 497.
[5] Med. Proef., Java, Suiker, 1925, No. 16, pp. 403, 404.
[6] This point arose from a conversation I had some ten years ago with Dr. H. L. LYON.

Many of the arguments used are however double edged and capable of application in an opposite sense. The Polynesians are intrepid sea voyagers whereas the Aryans were a purely pastoral people. If the Hawaiian Islands have been peopled from the South as their legends assert, a migration to India from the south Pacific would be well within the powers of these people.

NOTE BY THE EDITOR.

"*A*"—In the English translation of DE CANDOLLE's work we read as follows: "The epoch of the introduction of the sugar cane into different countries agrees with the idea that its origin was in India, Cochin China or the Malay Archipelago" and "It seems to me most probable that the primitive range extended from Bengal to Cochin China. It may have included the Sunda Isles and the Moluccas, whose climate is very similar; but there are quite as many reasons for believing that it was introduced into these from Cochin China or the Malay peninsula."

"*B*"—Our own view of the origin of the cultivated sugar cane is that two separate sources must be sought. The thick canes probably arose in some environment suited to their growth, such as is afforded by the larger islands off south east Asia, and especially New Guinea; while the Indian canes probably arose in the moister, eastern parts of India.

Morphological study supports the idea that varieties of the Saretha group may have arisen direct from *Saccharum spontaneum*, and probably the Sunnabile group from the Saretha. But we would not limit such a derivation to purely asexual methods, because of the free seeding of *S. spontaneum*[1] in north India, and the sporadic flowering of Sarotha there. The other groups which have been provisionally separated, Panashi, Nargori and Mungo, have not as yet been closely studied, but they appear to show a much less obvious relation to the wild species. It is *their* origin which has to be specially studied, and the suggestion that they are hybrids between thick canes and *S. spontaneum* has often obtruded itself in their cursory examination. Putting it tersely, the cross between a thick cane and either *S. spontaneum* or one of the thinner Indian canes is just a "North Indian cane." BREMER's work will obviously strengthen this point of view, although the possibility of sexual mutations occurring must not be lost sight of. DEERR's contribution is valuable, and throws some light on how the thick canes *may* have first come to India.

SULPHITATION PROCESS.—In a recent patent Johannes Manshot and Willem Appel[2] claim for an improvement of the sulphitation process, in which sufficient juice is run into a vessel with milk-of-lime to make it weakly acid or neutral. It is heated to 80°C., and transferred to a cylindrical vessel, where SO_2 is passed through it from the centre of the bottom, inducing circulation up through an axial pipe open at both ends. More lime is added in the outside space to give finally an acid juice of 12 mgrms. per litre of good clarity, which is easily filtrable.

ETHYLENE OXIDE has been recently discovered by the United States Department of Agriculture to be highly toxic to certain species of insects. Those commonly infesting stored food products, clothing, and furniture can be easily killed by the vapours of ethylene oxide in concentrations that can be used without danger from fire and that are not dangerous to human beings, viz., 2 pounds per 1000 cubic ft. of space, and at comparatively low temperatures, ranging from 60° to 75°F. It has excellent powers of penetration. Insects buried in overstuffed furniture, sealed in packages of cereals, and buried in jars of grain were killed with ease. Such foodstuffs as nut meats and dried fruits were unaffected, and no foreign taste or odour was discernable after removal from the fumigation chamber.

[1] On page 2 of Mem. VII. 1, the vegetative reproduction of the cultivated form is specifically mentioned as from a "first seedling."

[2] Dutch Patent, 18,227.

The Milling-Diffusion Process in Egypt.

By FRANCIS MAXWELL, D.Sc., M.I.Mech.E., F.C S.

Introductory.—Although the process of bagasse diffusion has been in operation for many years, it would appear that relatively little is known in regard thereto outside of Egypt (and Madeira). Information in sugar literature is singularly meagre ; and in these days, when widening interest is becoming keenly focussed on maceration problems, it may be opportune to direct attention to the merits of this process.

Bagasse diffusion should not be confused with cane diffusion. The latter signifies the treatment of cane sliced into the shape of " cossettes," whereas the former implies the co-operation of milling units. Cane diffusion has been tried out as far back as a quarter of a century ago : in Egypt under the late HENRI PELLET, and in Java by PRINSEN GEERLIGS and HAMAKERS. It was soon found to present practical difficulties, mainly in connexion with the slicing part of the process, and was consequently abandoned. To-day the diffusion of cane " cossettes " has, to the writer's knowledge, only survived at Cheik Fadl, in Egypt, where, however, a relatively small amount of cane is being dealt with daily.

The diffusion of bagasse was inaugurated in Egypt in 1904 at the sugar factory Abou-Kourgas. It has since then undergone considerable development and improvement. Having apparently given satisfactory results there, it was adopted in 1925 at the sugar factory Nag-Hamadi, with which this article will chiefly be concerned.

General Plant.—There are at this factory two identical trains or " batteries " for the purpose of juice extraction. Each consists primarily of twelve diffusion cells, which are preceded and followed by two milling units. The pre-diffusion mills, of which the first is a " preparatory " unit, serve to disintegrate the cane into a suitably fine state for diffusion, and to extract an initial amount of juice. The post-diffusion mills serve to press the bagasse sufficiently dry for the furnaces. It is the diffusion plant proper which plays the cardinal part in the extraction of sugar from the cane.

The diffusion battery is, in its basic design and principle, similar to that commonly used in beet sugar practice. It is, however, supplemented by an installation for the " forced circulation " of juice invented, by NAUDET.

Naudet Installation.—This consists essentially of a powerful pump, a compensator, and a series of quick-speed heaters. A system of piping and valves enables the formation of a complete circuit, comprising pump, compensator, heaters and diffusion cell. By this arrangement each cell can be cut off from the diffusion battery and switched on to the Naudet circuit.

Outline of Process.—The *modus operandi* of the milling-diffusion process may be briefly described as follows. The juice extracted by the pre-diffusion mills is measured, tempered, heated and then sent into reception tanks to await subsequent treatment in the diffusers. The bagasse from these same mills is carried to the diffusion department and discharged direct into the individual cells. It must here be remarked that there are always three cells, at a time, isolated from the diffusion battery : one filling, one discharging, and one under Naudet treatment. The remaining cells are meanwhile undergoing, in series, the standard practice of diffusion as universally practised in beet sugar factories.

Let us take one cell at random and follow its operation from beginning to end. It is first filled with bagasse, during which operation milk-of-lime is added in several doses. This serves to temper the juice contained in the

bagasse. When the cell is half-full of bagasse, a certain amount of juice (already treated and at high temperature) from the above-mentioned reception tanks is let in, and subsequently the filling with bagasse completed. The quantity of this juice corresponds approximately to that originally extracted from the bagasse to which it is now added. Thus we see that by this procedure the bagasse and the juice in the cell, as it were, re-constitute integrally their initial amount of cane, but in a condition that is most favourable to diffusion.

The next phase is what is called "meichage." The cell having been closed, juice is allowed to gravitate from the compensator into the bottom of the cell, and to rise through the column of bagasse until it emerges from a cock on the lid of the cell, when it is turned off. By this operation the air contained in the bagasse is removed. The compensator is continually replenished with juice coming from the last cell of the series undergoing common diffusion, the rest of this juice being diverted to the measuring tanks.

The "meichage" completed, the cell is then switched on to the Naudet circuit. All parts of this circuit are full of hot juice at the moment the Naudet forced circulation begins to operate. The pump takes the juice from the compensator, forces it through the heaters, and thence through the cell from top downwards again into the pump, and this cycle is repeated continuously for a short period. During this process the juice passes several times through the cell, each time having been previously heated under pressure until it reaches about 105°C. It is evident that the tall column of bagasse affords a most efficient filtering medium and consequently the juice, after its repeated passage finally leaves the cell bright and limpid. This juice requires no further treatment and goes direct from the diffusers into the evaporating plant after only passing through a fine gauze strainer, to remove entrained bagasse particles.

When the Naudet process is completed and the juice drawn off, this particular cell is linked on to the regular diffusion battery, and the next cell, that is the one that has just been filled with fresh bagasse, is switched on to the Naudet circuit. In this way each cell, in turn, goes through this process prior to forming a unit of the series undergoing diffusion proper. This latter operation is known to anyone familiar with beet sugar practice, and needs no description here.

The juice coming from the end cell of the regular diffusion series is sent into measuring tanks and thence also direct into the evaporators. The bagasse of each cell, having reached complete exhaustion is discharged on to a carrier and passes through the two post-diffusion mills into the furnaces. The liquid extracted by these mills, locally called "mill-waters," together with that pouring out of the bagasse discharged from the cells ("eaux de fosse") is collected in tanks. After they have been treated, the clarified part is used to supplement the water required for diffusion, while the sediment is removed from the factory.

Summary of Process.—The Naudet process of bagasse diffusion combines the three processes of extraction, filtration and purification of the juice. Its adoption, therefore, automatically discards all juice subsiders and filter-presses, and removes the losses, troubles and expenses notoriously attendant thereto.

Laboratory Data.—In order to afford a better insight into the milling-diffusion process some laboratory figures, representing the average of a whole season, are given below.

Daily crushing rate : 2600 tons (metric)
Cane : sucrose = 12·5, fibre 11, purity 80·5
"Soutirage" : litres of juice per cent. cane : 107

JUICE ANALYSES.	Brix.	Sucrose.	Purity.
Mill Juice (1st and 2nd mill)	20·1	16·2	80·5
Diffusion juice	14·5	11·7	80·8
Concentrated juice	53·5	41·9	80·2

BAGASSE ANALYSES.	Sucrose.	Fibre.
Bagasse after 2nd pre-diffusion mill	7·4	33·9
,, ,, diffusion	0·9	15·5
,, ,, 1st post-diffusion mill	0·8	39·6
,, ,, 2nd post-diffusion mill	0·7	45·2

ANALYSIS OF "MILL-WATERS."	Sucrose.
Mill-waters extracted by both post-diffusion mills	0·70

LOSSES IN MILLING-DIFFUSION PROCESS (THUS UP TO EVAPORATORS)	
"Waters" (from mills and cells)	0·06
Exhaust bagasse	0·19
Sediment from decantation of waters	0·10
Total losses	0·35

Extraction .. 97·2 (this figure is not directly comparable with that of milling factories, as will be explained presently).

Since the above figures were obtained (1927) there have been considerable improvements carried out in regard to the milling plant as well as to the manipulation of the diffusion. According to the latest figures of the present crop that have come to the writer's knowledge, the crushing capacity has been raised to approximately 3000 tons (metric) of cane per day, and the total losses reduced to below 0·30, equivalent to an extraction of about 98.

In comparing this extraction figure with the corresponding figure relating to common milling factories, it is important to bear in mind that the former covers all the losses incurred right up to the evaporation plant, whereas the latter are confined to the milling station proper and do not include losses sustained during the intermediary processes between milling and evaporation, i.e., tempering, heating, settling and filtration. If, therefore, account be taken of the sucrose loss in filter-cake together with the invisible losses incurred during this long period of juice treatment in ordinary milling factories, it will be seen that the Egyptian figure of extraction ranks amongst the highest obtained anywhere in the cane sugar world.

Merits and Demerits.—The Naudet diffusion process has a number of advantages, the salient of which are as follows.

One of its chief merits is, of course, that it does away completely with settling tanks and filter-presses. The juice coming from the diffusion cells, as stated before, goes direct into the evaporators without further treatment. And it must be remarked that this juice is brighter and clearer than the clarified juice that the writer has seen in many a defecation factory in other countries. Moreover, the diffusion juice is purer. For the purity of this juice as it enters the evaporators is practically identical with the purity of the first expressed juice. This is not the case in milling factories ; the purity of the juice entering the evaporators is usually one or two degrees lower than that of the first expressed juice, in spite of the separate clarification it has undergone. Another merit closely associated with the above is the relatively

short time in which the juice is under treatment during its passage from mills to evaporators. The Naudet circulation in itself lasts actually less than ten minutes. And another advantage is that all the juice is treated at high temperature in *closed* vessels.

Last but certainly not least is the very high extraction achieved by this process, and that with the use of a minimum number of mills and a reasonably small amount of water for diffusion. In regard to the latter it is often thought that diffusion necessarily implies the application of an inordinate amount of water as compared with that used for maceration in milling factories. This is not so. Indeed the maceration figures in the Hawaiian Islands and Queensland are, generally speaking, higher.

The only disadvantage of this process, to the writer's mind, lies in its somewhat complicated system of piping and valves, the manipulation of which requires a certain amount of experience from the native operators. Once the routine is acquired, however, the work proceeds smoothly and regularly without the slighest difficulty.

General observation.—In view of the above facts it is evident that the milling-diffusion process as practised in Egypt deserves wider attention than it has hitherto received. It inevitably provokes the question : Is it economically sound to adopt long and yet longer milling trains while ignoring the obvious inefficiency of imbibition as practised almost universally to-day ?

But it is not the intention of the writer to expand upon the subject in the present article ;[1] suffice it to call attention to the fact that a train of four milling units combined with Naudet diffusion is actually achieving superior results (at a reasonably high capacity) to the longest of milling trains in use anywhere, and coupled with this achievement is the considerable advantage in abolishing completely all settling tanks and filter-presses.

A New and Improved Trash Bar Setter.

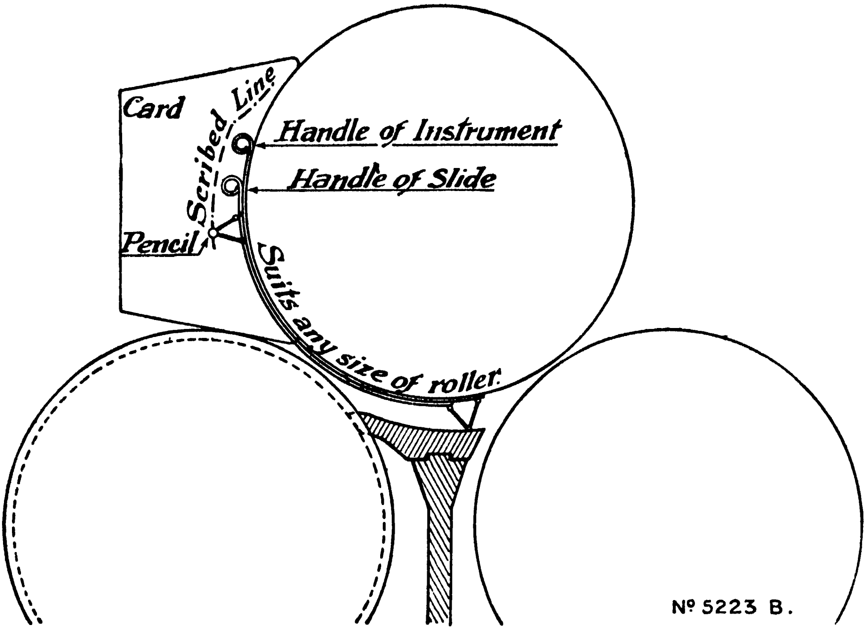
The improvement in mill work which has been noticeable in many factories during recent years is obtained by the observations of the engineers and their staffs, overhauling the mill in the off-season, and keeping every roller up to its work, and the mill in perfect adjustment during the grinding season. The work at some factories is always ahead of that of their neighbours, and this lead may not be due to better cane and better equipment, but to the operating staff seeing that good mill settings are found : then once they have been found, that they are maintained, or even improved during the season.

The setting of the mill rollers is easily measured by feeler gauges ; but a much more accurate method is to feed a slab of lead into the mill, which lead will take up all the slack that cannot be determined with feeler gauges, and the thickness of the slab after passing through the mill will show the roller settings under working conditions.

A very important factor in the successful operation of a mill is the setting of the trash bar or returner bar. To check the setting of this bar is an arduous job, requiring the uncoupling of the mill, stripping of top caps, brasses, hydraulic piping. platforms, and sometimes carriers and scraper gear, to raise the top roller. When the bar setting has been checked the reassembly of the mill takes as long as the stripping ; and since the work must be done hurriedly

[1] The writer will have an opportunity of doing so in a paper to be read at the next conference of the International Society of Sugar Cane Technologists in Java.

during the milling season there is a great risk of some minor defect occurring, such as dirt in the roller journals, or in the lubricating piping, leakage of the circulating water to roller journals, damage to hydraulic leather with careless handling, etc. All these cause trouble when starting up. In a factory equipped with an electric crane, the time taken to raise a top roller will be from $1\frac{1}{2}$ to 2 hours, whilst if all lifting has to be done with hand-operated tackle, the time will be three to five times as long, consequently the returner bar setting is left to chance until a long shut down.



An instrument for measuring the setting of the trash bar in a mill without dismantling was devised by Sr. JOSÉ GARCIA, Chief Engineer of Central "Hormiguero," Cuba, and under an arrangement with the Mirrlees Watson Co., Ltd., of Glasgow, is now available to all mill engineers. It consists of a Pantograph, one end designed to pass between the top and feed rollers, provided the opening is not less than $\frac{3}{16}$ in. When this end is in position over the trash bar, the Pantograph is opened to the full distance between the surface of the trash bar and the top roller. This distance is reproduced on a card by a pencil fixed in the outer end of the instrument. By moving the instrument across the bar, an outline of the setting is reproduced by the pencil. (See Figure.)

The instrument is called the "Hormiguero" Trashbar Setter, and supplies of apparatus have been sent to Mirrlees agents in all parts of the world.

DJOMBANG METHOD.—In Java at the Ketegan factory during the past three years the cane from each field has been ground separately, the so-called Djombang method.[1] Advantages of this mode of working are that the yields for the fields can be determined, and the values of the different varieties being ground can be ascertained. Lodged cane was not found to contain less cellulose than that which had been left standing. Cost of using this method is not more than 500 Dutch florins for the season.

1 *Archief*, 1928, 36, 1155-1164.,

Recent Work in Cane Agriculture.

SUGAR CANE IN UGANDA. **C. G. Hansford,** assisted by **W. G. McLeod.** Circular No. 19. Department of Agriculture, Uganda Protectorate.

In dealing with the cultivation of the sugar cane in any new country it is well, in the first instance, to get as clear an idea as possible of the environmental conditions ; and as readers may be in some doubt on this subject with regard to Uganda, a few prefatory remarks will be made, although the sources of information are somewhat meagre. The behaviour of the cane plant itself, both as to growth and maturity, is of course the main point at issue ; and the author assures us convincingly that this is all that can be desired. Thus the unusually great elevation (over 4000 feet above sea level) is no bar to cane culture, provided that its frequent effect in stunting growth or lowering the temperature is avoided. Both temperature and rainfall appear on the whole to be adequate and well distributed throughout the year. The tract, on the northern shores of Lake Victoria Nyanza, lies almost directly under the equator ; and thus low temperatures, if they occur, will be at night, and during the two periods when the sun is furthest north or south, namely in June-July and December-January. And, similarly, as the rains in the tropics usually arrive shortly after the sun is vertical, we should expect the less rainy periods near the Equator (where rains generally prevail throughout the year) somewhere around the same dates.

Judging from such data as are at hand, these conclusions appear to hold good for periods of comparative drought, which are expected during December and January and from June to August. But as regards temperature, in which many other factors are concerned, our conclusion only holds for the three months May to July, when the average monthly temperatures appear to be the lowest. The highest average monthly maximum during these three months thus far recorded is only 86°F., and the lowest average minimum 56°F., these records not of course running concurrently, that is in the same years. Such exceptionally low temperatures are of course distinctly unfavourable to rapid growth of the cane ; and may be roughly put down as due to the fact that the cane is growing at higher altitudes than is usual. It is not surprising, then, to note that the growth period in plant canes is put down as 18 months and in ratoons 15. Obviously, with a well distributed rainfall, the sometimes baneful dominance of the harvesting season upon that of planting is less in evidence than in many countries, and in a series of experiments McLeod was unable to determine the correct planting period : successful planting of sets was experienced in every month of the year. The average rainfall is round about 50 in., the minimum from 1911 to 1914 being 42 in. and the maximum over 60. The average number of hours of sunshine is given as slightly over 5 per day, arguing considerable cloudy periods, which would encourage growth and diminish evaporation.

The pamphlet is written by a pathologist whose work in sugar cane and cotton is well known. It aims at bringing up to date the former publications (Circulars 5 in 1921 and 12 in 1924) ; but is cast on entirely different lines, and is the fullest account we have met with on the sugar industry in this part of Africa. Moreover, it gains greatly in value from the assistance of the manager of a successful, up-to-date modern sugar factory established on the shore country of the Lake within the last five years.

What then are the prospects held out ? The great distance from a sea port is held to more than counter the natural advantages in the field, and thus to bar Uganda from entering the world's markets for sugar ; although the possibility is suggested of sending some to India later. On the other hand,

there is a potential market for sugar at the very doors ; and recent railway extensions, opening up the network through Uganda, Kenya and Tanganyika, present a further market capable of almost indefinite expansion. The natives are already acquiring a taste for such European amenities as " clothing, tea and sugar." The factory at Lugazi makes only plantation white sugar, and is already producing quantities of motor spirit. This, it is claimed, will make a great improvement in the heavy local transport of such a heavy commodity as sugar.

As an offset to the long growing period, the resulting tonnage figures are imposing. The highest yield obtained was from a small field of red soil and worked out at 110 tons per acre. On good red soils 60-80 tons have been recorded, and an average of 60 should be obtained with first class cultivation and attention. " The industry is as yet too young to say for how many years this tonnage may be expected, but up to the present it shows after 5-6 years no inclination to lessen." The red soils of the elephant grass land of the Lake Victoria districts are very suitable for the crop. It is possible that other soils will also be found doing equally well, but these have not as yet been investigated. But this fertile red soil of Uganda has the disadvantage that it is "patchy," with intervals of gravel, which although it may lighten the clay after mixing will add to the cost of cultivation.

Uganda is well supplied with cane varieties, lists being given of the kinds introduced from 1916 to 1928. Such introductions are admittedly dangerous ; but, after all, with proper care and careful study by a competent pathologist before distribution, the danger is very much less than it was formerly. The standard canes at present grown appear to be Striped Ribbon and Striped and Black Tanna ; canes which certainly suit the local conditions and give very heavy yields, but which also are susceptible of improvement : and the lists include most of the outstanding varieties of recent years, up to and including POJ 2878. Uganda may well call a halt till the 25 new kinds have been fully examined at the Government plantation at Kampala. There is, wisely, no intention of attempting to start seedling work, at any rate for the present.

A general account is given of the sugar cane and its mode of growth, its needs and the most suitable methods of cultivation. These latter are by no means as care-free or slovenly as might be expected from the ease of growing large crops with little trouble ; it is instead a serious attempt to make use of all the best methods at the start, in place of painfully introducing them when crops are decreasing in quantity. But the industry is very young, and the yields are perfectly satisfactory, so that the addition of artificial fertilizers is, from economic causes, at present " out of the question." This attitude is reasonable, but manuring will without doubt be held in mind, and when necessity arises a fund of information will have been gradually accumulated for such action as is needed. One thing is very strongly insisted on, and that is the use of every fragment of cane trash, for incorporation with the soil as the best means of maintaining its natural fertility.

The paper concludes with a series of balance sheets prepared by McLEOD as to the cost of each and every item in the field work, on the one hand by manual labour (which is put down at 9d. per day), and on the other by implemental cultivation. In each case, plant canes and four ratoon crops are included ; and the tonnage is put down as 50 tons per acre for the first four and 40 for the last.

The summary of the results of the hand-worked test is as follows : Five crops of cane, in the ground for 78 months and yielding 240 tons of cane, cut

and loaded for the factory : total cost 895s. Mechanical tillage does not include cattle, for these cannot be employed because of disease, and was only used for the plant canes : total cost for the same tonnage 862s. Thus the average cost of a ton of canes was 3·75s. for hand labour and 3·60s. for mechanical tillage.

Numerous details are given of fungus diseases and insect pests met with in the fields. But the greatest trouble appears to be a pernicious grass "lumbugu" (*Digitaria abyssinica*) which is described as "one of the most difficult problems the planter in Uganda has to deal with, whatever crop he plants." The matter is carefully considered, and the best way to eradicate it suggested.

PROCEEDINGS OF THE ANNUAL CONFERENCE OF SUGAR TECHNOLOGISTS OF CUBA, DECEMBER, 1928.

At this Conference the Chairman, C. T. CRAWLEY, in his opening remarks, ran over some of the most pressing problems of the Cuban sugar industry at the present day, all of which as everywhere else, either directly or indirectly, were concerned with growing more cane at a smaller cost. The first need was the proper organization of the work ; and this required a larger number of young trained men than are locally available. When, fifteen years before, he was in charge of the Experiment Station in Porto Rico it was found impossible to secure young Porto Ricans to fill responsible posts in the factory or on the plantations ; but on a recent visit he found that all this had been changed ; a well equipped Agricultural College turned out men who were soon able to occupy positions of responsibility on the station, in other Government departments and on the plantations : the Cristalina cane had gone, and the industry was hopeful and prosperous. Cuba, the Chairman stated, was now in the position occupied by Porto Rico fifteen years ago.

A closer connexion between field and factory was the next most pressing need. At present there were two practically independent sections of the industry with entirely different aims, the one to grow as great a mass of canes as possible, and the other to get all the sugar out of it. CRAWLEY referred to the case of a factory which had shown such excellent yields that the Cuban Sugar Club arranged for an investigation and report as to its cause. The result was as significant as simple : it was merely the most complete organization of a well thought out scheme of operations ; so well designed, that when it was noted that the percentage of sugar dropped for a few days, it was at once traced to a delay in getting the canes milled because of a minor breakdown in the machinery. Every detail, from the cutting of the cane to the bagging of the sugar went like clockwork, a result which brought credit alike to the men in the field and those in the factory. This of course touched only one part of the whole complex ; and CRAWLEY suggested what appears to be a very sensible move for the closer contact between those responsible for the growing of the canes and the technical staff. This was to depute one or more of the chemists during the off season to the fields, in order to assist the field inspectors in such duties as the propagation of varieties, control of mosaic, selection of seed, as they could not be properly done in the time at disposal. These members of the factory's scientific staff would have no difficulty in soon learning the technique required, and thus a liaison would be effected between the two great sections referred to above.

The third problem mentioned was that of the moth borer. This was gradually impressing itself upon those in charge of the industry, whether in the field or factory ; for sampling by car load or otherwise was being more widely

carried out, and the obvious fact that many canes were attacked and therefore of less value was becoming more insistent. CRAWLEY stated that this work fell to the lot of the scientific staffs employed in the field, and that the actual grower is powerless ; but we are not so sure of this, and regard the latter as perhaps in the better position, if properly instructed, to tackle the evil. And at any rate theirs is a great part of the loss in the lighter loads of cane sent in.

Irrigation was the next problem, and the example of Hawaii was naturally used to convince of its importance. A recent Hawaiian visitor in writing an account of his impressions showed scant sympathy with the Cubans over their recent crises because of their "non-progressive spirit." For one thing the Cristalina cane had been rejected in Hawaii because of its unsuitability for irrigation work. And the speaker observed that there were known to be large areas in Cuba where water within 50 ft. of the surface was waiting to be used. It was also idle to shelter behind the assertion that the soils of Cuba were inferior to those of Hawaii. There were certain tracts where this was not at all the case, but no proper study had been given to the subject. Quite recently an imposing work had been published on the Cuban soils, but this was not going to be of any use, till the planters themselves examined the soils on their plantations and found to what series in the classification they belonged. In other words, Cubans were admittedly behind the times in the scientific study of their plantation work ; and until this was remedied troubles would still be their lot as in the past. The final move in this direction hung upon the co-operation of the cane growers, and that this was their wish was shown by the attendance gathered together—altogether an inspiring address.

SOME EXPERIMENTS WITH THE UBA CANE. **J. Alfaro.** Proceedings of the Cuba Technologists (as above).

These experiments were made at Central Portugalate in Santa Clara Province, and are of much greater interest than the title would indicate. The Uba cane was introduced to this Central in 1925 for countering mosaic. The idea was to plant the cane in long, broad strips around the Cristalina fields which showed secondary infection, in order to prevent access of *Aphis maidis*. The experiment failed, for the protected fields showed as much as, if not greater infection than the rest ; but it had an unexpected result, owing to the planting of Uba on many different kinds of soil where it would not have otherwise been grown. Among other details of the Uba behaviour, it is mentioned that the labourers much preferred cutting Uba, which was always burnt, to Cristalina, for they could earn so much more money in the day. Also that Uba tops were a great favourite with the cattle because they contained so much greater nutriment than the local "pasture," which throws more light on the character of the environment.

The chief interest, however, lay in the behaviour of the juice obtained from canes grown in different localities. For it was observed that the purity fluctuated between 62 and 86. This strange behaviour suggested some connexion between purity and the character of the soil : Uba did best on high, well-drained land. Extensive physical analyses were accordingly made, but no correlations were observed. Next the *pH* values were studied, and at once a relation was established ; for it was observed that high purities were obtained where the *pH* was 7·2 and upwards, medium purities were found in canes grown where the *pH* was about 7·0, and low ones where it was 6·5 and under. During the season 234 such analyses were made, the canes being ground in a laboratory mill with the following results : with *pH* 6·5 the purity averaged

64·02, with 7·0 it averaged 77·01, and with 7·6 it was 95·00. During the next season, at the end of 1926, the number of analyses was extended to 503, and separate tests were arranged for spring and frio plant canes, and for ratoons—with much the same results.

These observations caused a further planting of Uba, upon all the lands with high *pH* values which were unprofitable under other varieties. Meanwhile, in August, 1927, attention was drawn to HADDON's work on the presence of starch in the Uba cane when it was grown in acid soils, with no indication of it on alkaline; and his conclusion that this substance was the chief impurity of the juice and the cause of its difficult working in the factory. The author also refers to the short paragraph on the subject in this Journal in November, 1927 (p. 609).

When the crop had matured there were some three million arrobas of Uba cane available, and a very large programme of analyses was proposed for furthering the study of the relation of *pH* values in the soil to the purity of the first mill juice. Owing to restriction, however, less than one tenth of the large crop of Uba was ground; but all of this was analysed car by car. It was observed that the canes were much affected by borer. Differences in the same sense as before were noted, but they appear to have been far less marked than in the two previous years. Nevertheless, the results of the 500 analyses are here given, as taken from the summary at the end of the Table.

	Number of Analyses	Brix	Sucrose per cent.	Purity
Acid soils	274	18·93	14·18	74·91
Neutral soils	13	19·52	15·47	79·18
Alkaline soils	213	19·69	16·31	82·86

A careful study was then made of the effect of the borer on the character of the juice, the fibre content and the mill extraction. A Table gives the averages obtained in the analyses made on the part of the cane attacked, on the part free from attack, and on perfectly sound canes; the points considered being the normal extraction, Brix, sucrose per cent., purity, glucose per cent., glucose ratio, fibre per cent. in cane, and yield 96 grade per cent. sugar. The average borer infection of the Uba cane in this area was 32 per cent. in ratoons, 34 per cent. in spring, and 78 per cent. in fall cane, and 86 per cent. in left-overs. The remainder of this paper consists of a comparison of the yield and cost of Uba and Cristalina canes grown on the poor lands, which appears abundantly to justify the economy of planting the former cane upon them.

REPLANTING AND CULTIVATION OF REPLANT AND RATOON CANES. **E. S. Walker.** Central Preston. Proceedings of the Cuban Technologists (as above).

This paper gives a careful account of the practice in cane cultivation on the tract around Preston Central, situated in Oriente on the extreme eastern end of the northern coast of Cuba. A reference by the writer to BENNETT and ALLISON's "Soils of Cuba" reveals the fact that the soil here belongs to the Alto Cedro clay, an important type on the lower stretches of this part of the island. It is described as a good soil with local salty depressions, the surface being of the "hog-wallow" type; and as an ashy grey clay with a variety of heavier clays below, and thus lacks drainage. It is important to level it down as soon as possible because of the depressions on the surface, in which water collects and which therefore ultimately becomes salty. The surface soil weathers to small angular fragments, which however have no

power of preventing evaporation. It is obvious that very thorough working will be necessary for the growth of healthy sugar cane crops.

The work is almost entirely done by mechanical implements of which a number are mentioned; and the paper is illustrated by 14 full-page plates showing them at work (these are evidently enlargements and not always clear). The account commences with virgin land, and treats of plant canes and ratoons in succession. But the chief point of interest lies in the work on the latter, including the inevitable supplying of vacancies—work which aims at raising ratoon cultivation to a new level, and fittingly termed "renovation," as is shown by the following extracts: "The canes will develop almost like replanted ones, and it is logical that the practice will be cheaper. It is not known how long this may be continued, but probably for many years. It has proved so successful that we have been able to renovate fields that we intended to abandon with entire success; and at a cost very little as compared with that of replanting. Because of the absence of new land and the uncertainty of the weather, our efforts are concentrated on keeping the existing cultivation as long as possible."

It is obvious that this renovation will largely depend on the care taken in the treatment of the land from the very commencement; therefore the main course of the local practice is here summarized. In virgin land clearing and burning the stumps is the first operation. The smaller ones can often be removed by a 10-ton tractor armed with heavy chains, and lunging in different directions; larger ones may be dynamited and split up, while yet others may be burned out, by heaping up litter and blocks of wood and lighting the pile.[1] For ploughing, a heavy La Crosse disc plough is used, i.e., a 10-ton tractor drawing of 5-disc plough which must be of rugged construction because of the roots. But the present tendency is towards lighter instruments because of mobility and a larger range of utility and less cost, e.g., a 2-ton caterpillar which is specially useful for pulling heavy harrows. One ploughing followed by two or three harrowings will usually suffice for the preparation of the land for planting, but it must be allowed to settle, as compactness is necessary for capillary action in the soil.

Steam ploughs are rugged in construction and do very good work, being supplied with knifers below for cutting the deep roots. But deep ploughing is not always useful because of the heavy subsoil, and knifing pulls up little. Furthermore, the extra depth is countered by the plasticity of the clay, which quickly becomes compacted again. The relative costs of the three types are: for steam tackle 100, the larger tractors 75 and the smaller 60; though with very large areas the cost of the steam plough will approximate that of the large tractor.

After the soil has been prepared and settled down, two kinds of planting may be employed, ordinary pick work and planting in furrows; the distances being 6 ft. × 6 ft. and 6 ft. with 3-6 ft. in the row respectively. The latter has considerable advantages. It is slightly less costly, but the chief point is in the quickness of work, so that the planting may be done before the rains come. If, furthermore, the canes show above ground before the onset of the rains, it is possible to get in one more cultivation. This enables the cane plants to get ahead of the weeds, and after a rainy period of three to four weeks they never lose their lead, with the result that they may even close in with hardly any hand weeding. For instance, one 23-acre field closed in

[1] It is not very clear whether virgin land is always ploughed according to the description that follows in the text; for later on the author states that because of the *saltagenos* resulting from hog wallows, "it is considered highly important to cultivate all virgin land areas within a few years after they have been planted."

after 12 implemental cultivations and only three light weedings altogether, at a total cost of $8·32 per acre ; but the weather in this case was particularly favourable for the practice. For planting, a special wagon has been constructed with three projecting boxes, one on either side and one behind, from which three men can take the seed pieces for three different furrows at the same time, the wagon being drawn at a slow, steady pace by two mules. Immediately behind the planting wagon come the covering implements, a 6-8-shovel riding cultivator or an 8-disc harrow.

The following implements were used on the 23-acre field mentioned above : 5-shovel cultivator, 6-shovel wheel cultivator, "A" spike-tooth harrow, two-mule disc harrow. On some fields others are used besides these, e.g., 7 in. mould board plough and 3-shovel cultivator. Occasionally, after very hard rains, a very heavy plough or cultivator is needed to properly loosen the soil, but light cultivators are always preferred because of their weeding and mulching powers and the prevention of evaporation and cracking of the soil. Great care is needed to carry the cane plants through the dry periods, two of which may be looked for every year, each of a couple of month's duration, one in summer and one in winter.[1] Evaporation appears to be comparatively great in the tract, because of the hot sun and prevailing high winds– the latter very evident in one of the photographs.

The treatment of the ratoons is specially thorough and careful, and the principle adopted is the heaping of the trash in alternate spaces, and cultivating the others : thus one space is cultivated while the next retains a covering mulch of trash, through which sometimes, it is true, weeds will penetrate. On occasion it is thought advisable to cultivate the whole ground by moving the trash, but this is rarely done. The operation of trash heaping is one in which considerable economies may be effected. The two-mule hay rake travelling across the rows works twice as cheaply as hand labour; while turning the trash to one side by the side-dump hay rake working along the rows is useful where the trash is lighter. This operation, coming at a time when harvesting is in full swing, makes it particularly important that implemental work should be employed; and the insistence on this by the author appears to emphasize the importance of attending to the ratoons as soon as the canes are cut, as is the case in Hawaii, recently mentioned in this Journal.[2]

After clearing the trash from the space between two rows the first cultivation should be by plough ; and the two-ton tractor pulling a heavy two-disc Saunders plough is recommended as doing very efficient work. This plough goes up one side of each row, shaving down the stools and leaving the space thoroughly turned up, and uprooting all the weeds and any trespassing cane plants. It is followed by a pulverizing cultivator with a disc harrow or shovel cultivator. Supplying is then done, selecting with great care and transporting parts of stools, which are planted in prepared holes by a spading fork and settled down. If this is done and cultivation kept up there is no reason why the growth should not be as good as in newly planted canes. The cost of cultivating ratoons will of course depend on the condition of the field and the canes at start, but records kept indicate that it will not greatly differ from that under the old hand systems. The cost of the work may be gauged by the following statements. Moving the trash by hand requires from two to three man-days per roza (1·77 acres) ; in turning trash by hay rake, one

1 The average rainfall at Preston is given by the publication mentioned below, for 17 years, running from January to December as follows, in inches · 4·03, 2·21, 1·25, 2·88, 4·65, 2·36, 1·50, 2·08, 3·88, 6·42, 8·21, 5·31 ; totalling 44·81. The dry periods thus appear to range from February to April, and from June to August. "Rainfall and Temperature of Cuba." O. L. FASSIG. Tropical Plant Research Foundation. Bulletin 1, 1925.

2 *I.S.J.*, 1929, 142.

man and two mules will do two to three rozas per day. Small tractors drawing a two to three-disc plough with one operator will cultivate about four rozas per day : follow-up cultivations will be at about the same rate, four rozas per day.

Burning the field before cutting cheapens the operations, and it is possible to cultivate both spaces ; but the value of the trash is considered to be so great that this is practically never done in the tract in question. The paper concludes with a statement regarding experiments with various leguminous crops on areas where the humus is deficient, and cowpeas have been found to be the most profitable ; but it not stated whether this practice has as yet passed the experimental stage.

DRAINAGE. **S. K. Meigs.** Proceedings of the Cuban Technologists (as above).

In this paper the author deals with the financial results obtained by draining one of the many refractory clay soils met with in the southern coastal plain of Camaguey. The soil is described as dark, hogwallow land, underlain by impervious clay, a soil on which it is most difficult to maintain a profitable growth of cane. In 1921, 95 caballerias (about 3135 acres) were planted with cane, and the yield at 20 months was about 10 million arrobas (of 25 lbs.) of cane (practically 40 tons to the acre). In 1922-1923, the yield dropped 53 per cent. Extensive ditching was then commenced, and during the two following years $45,000 were expended in draining the land. The drains were laid out according to observations on the direction of the flow of water, during slight floods or after heavy rains ; although in some cases the fall was so slow that the mud had to be stirred in the pools and the direction of the spread of discoloration noted. The main drains were led into several small *arroyos* (rivulets) which crossed the area.

In 1923-1924 there was an increased yield of 751,000 arrobas, and in 1924-1925 of 1,211,000 arrobas, over the 1922-1923 crop, making together an increase of nearly two million arrobas. This was put down to the effect of draining the land. On this basis the cost of drainage was more than covered in two years, with sugar selling at 4 cents, and would be half covered when sugar was at 2·5 cents ; not taking into account (1) the saving of the canes which would probably have had to be abandoned (a loss of $140,000), and (2) the great and permanent improvement in the fertility of the soil through having been drained. The drains were all made by hand labour ; and the author demonstrates that, except the main drains, these could have been much more cheaply made by mechanical implements—ploughing, cross ploughing, harrowing and making bank and ditch with Martin's grader. He then takes the case of the colono and works out his gains and losses, incurred through draining his land and neglecting to do so. And concludes that hundreds of caballerias of the richest land in Cuba are allowed to give year by year their minimum yield through the lack of proper forethought in draining it before planting (thus fully justifying the remark of the Hawaiian visitor referred to in CRAWLEY's opening address as to non-progressive spirit in the Cuban sugar industry).

C. A. B.

ALCOHOL FUEL.—A factory having a capacity of 750,000 gallons per annum is being erected at Sarina, near Mackay, Queensland, by the Australian National Power Alcohol Co., Ltd., in which the Distillers Co., Ltd., have an interest. Absolute alcohol (15 per cent.) will be blended with petrol (95 per cent.) and sold as "Shellkol" a co-operative agreement having been concluded with the Shell Co. which will undertake the sales organization. By-products from the fermentation process will be utilized for the production of fertilizers, fodders, etc.

Sugar Cane in the Argentine Republic.

Some Figures illustrating Yield.

Since we published last month an article by Dr. Cross on "The Cultivation of Sugar Cane in the Argentine Republic," we have received from him some additional data relating to the yields obtained in that country. The results of the years 1924 to 1927 are given in the Table below. It will be noted that they vary considerably from year to year, due to the exigencies of a sub-tropical, continental climate. Of course it must be remembered that these are average figures, and include the poor lands, and the indifferently cultivated properties, as well as the richer soils and the better attended estates; and that the data for the factories include those of the older ingenios of comparatively low efficiency as well as the large modern installations. Thus in Tucumán in 1927 there were whole plantations which produced over forty tons of cane per hectare, and ingenios which made over 170 kilos of sugar per ton of cane, though the averages for the province are considerably lower than these figures. It must be borne in mind too that the cane is harvested every year, so that the results cannot fairly be compared with those of "gran cultura" of many other countries.

TABLE III.

PRODUCTION OF CANE AND SUGAR IN TUCUMAN, JUJUY AND SALTA, 1924-1927.

	Year	Tucumán	Jujuy	Salta
Hectares of cane harvested	1924	104,000	15,000	4,700
	1925	112,170	16,768	5,100
	1926	112,170	15,599	4,760
	1927	127,053	14,823	5,378
Metric tons of cane ground	1924	2,567,743	619,663	171,082
	1925	4,489,600	780,480	196,582
	1926	4,501,521	783,695	308,019
	1927	4,213,301	734,627	314,270
Metric tons of cane per hectare	1924	24·68	41·31	36·40
	1925	40·02	46·54	38·54
	1926	40·13	50·24	64·71
	1927	33·16	49·56	58·44
Metric tons of sugar produced[1]	1924	176,123	52,098	13,938
	1925	309.916	65,149	15,101
	1926	373,356	67,589	24,183
	1927	325,519	61,115	25,369
Factory yield per cent.	1924	6·86	8·41	8·15
	1925	6·90	8·35	7·68
	1926	8·29	8·62	7·85
	1927	7·72	8·32	8·07
Metric tons of sugar per hectare	1924	1·69	3·47	2·96
	1925	2·76	3·88	2·96
	1926	3·33	4·33	5·08
	1927	2·56	4·12	4·72

CUBAN CROP FORECAST.—Messrs. Guma & Mejer on March 11th issued an estimate of the current Cuban crop as expected from 163 centrals in operation. This amounted to 36,529,000 sacks of 320 lbs. or 5,218,428 long tons. About the same date the Cuba Sugar Club put the probable production at 5,064,150 tons.

[1] The greater part white sugar for direct consumption.

The Cane Position in North Bihar, India.

With Special Relation to the Factory Industry and the Early Crushing Problem.

By WYNNE SAYER, B.A.[1]

It is now some six years since the original Co canes—Co 214, Co 210 and Co 213—were selected, tested and distributed to growers in North Bihar, India, by the Sugar Bureau and in the interim with the exception of the distribution of Co 205 as a cane for special conditions, these canes have been allowed to find their own level among growers and it has been possible by carefully noting the results over a number of years to check out and correlate the exact type of cane which is required in the tract.

The position in North Bihar is probably unique in cane growing countries. Such are the climatic and rainfall conditions that it is possible to have a couple of years in which it would be perfectly feasible to grow tropical canes and grow them satisfactorily. But such a couple of seasons might be followed by a year in which Co 205, which is the hardiest of canes, would alone do really well and all the tropical canes would fail entirely, while after this might come a less noticeable variation over a period of years in which Co 210 and Co 213 would alternately prove the better suited to the prevailing conditions. Such climatic variations make the selection of a standard cane a matter of very great difficulty, and as in the present state of the industry it is essential to secure a large and regular cane tonnage for both mills and growers, the writer considers that the time has come to review carefully the present position and see in what directions we in India can safely advance and where, in the light of the experience we have gathered, it will be necessary to retreat slightly in order to consolidate the position. At present we have a rainfall of 45 inches spread over four months during which it is by no means regularly distributed. It may come late and cease early. It may come early and cease late or come early and cease early, all the variations in the rainfall affecting the growth and ripening of the cane in proportion. We are therefore forced in selecting a cane to take into consideration all these extremes in rainfall coupled with the fact that the cane must be able to keep itself alive, if necessary, through the three hottest months of the year, which can pass without any rainfall, and then immediately the rains break, come away and grow at a record speed to ripen in November with a decent tonnage. It will thus be seen that a standard cane is almost impossible and it is necessary to have a selection of canes to suit the variation of the seasons and, in short, the grower must never pin his faith to one type of cane alone. Four types of cane are now being grown.

Co 214, an early ripener with high sucrose and low tonnage, very hardy, essentially a mill cane and as such not in favour with free growers.

Co 210, a medium cane for light lands, a good cane in a short rainfall and an excellent ratooner.

Co 213, a medium thick cane for good lands with high tonnage in a good rainfall year but unable to give full tonnage unless the rainfall is right up to average.

Co 205, a hardy cane for bad lands and water-logged areas ; essentially a cane for areas where no other cane will grow.

It will thus be seen that most of the climatic variations have been guarded against in giving out these canes, and the grower who cultivates all four is

[1] From *Agr. Journ. of India*, XXIII, VI, 424-431. This valuable paper is reproduced here not only because of the growing interest evinced outside India in the Co canes but also because it sheds a clear light on the extreme difficulties of the Indian White Sugar industry.—ED.

almost certain of a good crop from two of them whatever the year may be. Now it must be realized that so long as mills and growers are independent of each other, there can be no settled cane policy. The mill wants sugar, the grower wants tonnage, and these two points are at present not easily combined in the same cane under North Bihar conditions, especially in the direction of early crushing. To obtain the extra sugar the mill offers a premium to make up for the smaller tonnage produced per acre by the grower if he plants the present type of early ripening cane. *Now* early ripening canes, if the mill *can* and *will* take them off in early November, undoubtedly offer a great advantage to the grower, who can get his land cleared and resown for *rabi*, and this to some extent does compensate for tonnage losses, but, on the other hand, the position of the grower who has relied on this fact and yet finds the mill delaying its opening is parlous.

But the mill has also perfectly definite reasons for such delay. No mill is going to start in early November to crush a few thousand maunds of Co 214 or a similar early ripening cane and then be forced either to close down or continue its run on unripe cane of another variety until the later ripening canes are ready owing to a lack of supplies of early cane. This means a dead loss to the mill. It is thus clear that under present conditions early starting and the growing of early ripening canes are linked together, and that unless the growers each do their share towards putting down or guaranteeing a small area of early cane, no mill can or will open early. Unless we have early opening, *no advantage from the grower's point of view is to be found in growing Co 214 or any similar low tonnage early cane.* Should the mill possess sufficient land of its own to enable it to grow early cane for November crushing, well and good—failing that, it is forced back on to premiums and other unsatisfactory methods of ensuring a supply.

This question of supply is a vital one. The longer season a mill can work, the lower the overhead charges will be, but the length of the actual working season is considerably affected by two factors :—(1) The percentage of sugar in the cane. (2) The percentage of sugar the mill obtains. That is to say, no mill can work at a profit on normal sugar prices if it is not extracting a certain percentage of sugar from the cane and the most efficient mill in the world cannot extract sugar which is not present in the cane. Therefore no mill is going to start working unless it has a certain percentage of sugar available in the cane which it can reasonably expect to extract or is forced to get off a big crop under agreement between dates.

Now assuming that October to June is the longest possible crushing season, limited at the end by lack of cane and at the beginning held back by absence of sugar, at present with a big crop half November-December-January-February-March-April are the milling months covered by the canes Co 210 and Co 213 and Co 205 which are the standard mill canes through these months.. May and June only come in if there is an excess of cane and this working is a source of considerable profit to the mill but is not regarded favourably by the grower who sees his cane drying on the field and has endless trouble in getting it cut and stripped as the tops have often dried off. We have then October and half November to deal with and these six weeks represent the early crushing season, a period when the grower is anxious to supply all the cane possible in order to clear his land and sell his cane at its greenest, while the mill hangs back in the case of ordinary canes—waiting for the sucrose content and the purity to rise and finally starting on ratoons if no early ripening cane is to be had. At present Co 214 represents the only cane which can really be worked at a profit during this period (I am taking an

average year and not dealing with short rainfall or a protracted monsoon, both of which occurrences affect cane ripening and expedite or delay the mill opening), but does not represent a cane which is ever likely to be popular with free growers who are paid on a tonnage basis.

Now there are two ways of obtaining a certain amount of sugar per acre, which is the factor the mill looks at and on which payment for cane is based :—(1) By growing a high sucrose cane of comparatively low tonnage ; (2) By growing a lower sucrose cane of higher tonnage. The amount of sugar obtained by the mill is the same, but in the first case it pays less per acre for its raw material and has to crush less. In the second case, it pays more per acre and works more cane.

To date we have tried 1 and it has proved a failure and has only been kept alive by the payment of a premium. Now it is obvious that, if we can strike a mean between 1 and 2, we have every chance of reconciling mill and grower by giving the grower a chance to make as much money per acre on a tonnage basis as he can with the later ripening canes, while the mill gets its sugar and its extended working season and pays no actual premium. To accomplish such a reconciliation, we must have a high tonnage, good sucrose, early ripening cane, and if we get these three factors combined, other minor points will have to be passed over. The independent grower is a free agent and the mill is dependent on the grower and therefore both sides must try and meet each other in this matter.

Payment by sucrose basis is often advocated as a method for getting early ripening canes grown. In India, where the majority of small growers are illiterate, it is merely a further opportunity for the weighing staff to swindle the grower and, pending the arrival of the millennium described as compulsory universal education, no steps can be taken to introduce such a system —whatever may be the practice in other countries. The position may therefore be summed up as follows :—

To ensure early opening and a full supply of cane, it is necessary to give the grower a tonnage cane ; which the mills demand must be fully forward, say 80 purity by mid October. Such a cane is yet to find and my last examination of the new canes in the testing plots at Pusa leads me to believe that certain changes will be required, as the essentials required are not to be found in combination in any known cane yet, but this is dealt with further on. Leaving aside the question of special canes, early and late, for special types of land and conditions, which are an outside line of work, we will now come to the main crop.

Here we have two points to consider :—(*a*) The big tonnage cane which requires a full monsoon to show its best—but loses heavily if conditions are unfavourable. (*b*) The medium tonnage cane which can improve in tonnage with favourable conditions and does not drop so heavily if rainfall and conditions are unfavourable. *a* and *b* above represent Co 213 and Co 210, and from the details I have collected in the past few years it is clear that conditions and opinions are changing. When the three canes Co 210, 213 and 214 were first given out in 1923, everyone took up Co 213 and with the exception of a few places (mostly large growers' estates on light land) Co 210 was not regarded favourably, while Co 214 was looked upon as a clear example of favouritism towards the mill. The ryot went entirely for Co 213 regardless of what class of land he was going to plant as it was the heaviest yielder. A survey of the position now shows that Co 210 is steadily and surely consolidating its position and is gradually working its way into the place formerly occupied on certain classes of land by Co 213. It is the reason for this

change which is the important thing to discover, because it must obviously influence future cane policy in the tract as Co 210 and Co 213 are not by any means canes for similar conditions. With the grower paid on a tonnage basis, it is evident that tonnage is the acid test on which the change has come about.

Examination of Co 213, however, does not show—

(1) That it suffers more from disease or from borer. As regards borer attack, no Co cane in particular can be said to suffer badly, though Co 210 with its upright flag shows borer attack more distinctly than the other canes, but the great vitality and growing power of these canes enables them to grow past top borer attack to a great extent and Co 213 cannot be said to be inferior to Co 210 in this respect. In the case of mosaic disease, though Co 213 has slightly more mosaic infection than Co 210 (0·3 and 0·05 per cent. respectively) as found by taking seven samples from seven separate estates, evenly distributed through the cane growing area of North Bihar, yet the total amounts are so small that no drop in tonnage could be traced to such infection and no differentiation between the canes on this account could be sustained.

(2) Any sign of tonnage drop under favourable conditions. As regards tonnage, Co 213 is still an easy 200 mds. ahead of Co 210 in a good year and as a strong land cane in a good rainfall year, it has capacities for tonnage which Co 210 can never attain to.

(3) That it is any harder to handle or more troublesome to grow than Co 210. The exhaustive and thorough tests these canes were put through before distribution included all these points and the conclusions arrived at then still hold good everywhere.

The reason is a deeper one. Since the distribution of these canes in 1923, the monsoon has shown a distinct tendency to lighten. The actual total rainfall for the year may appear the same or even show a slight increase, but an increasing quantity of this rainfall is received in fractions of an inch and not in the steady heavy falls required to grow a big cane. It will thus be seen that it appears as if the actual effect of the rainfall was on the light side as compared with past years. Now such a happening at once limits the land on which Co 213 can do really well and increases the area on which Co 210 may be expected to do its best and the result is as above. The lighter and more resistant cane is proving the most reliable cane over the average of years and it would appear that this fact must be carefully borne in mind in selecting suitable canes for the tract in the future.

Such a statement in no way governs areas where the rainfall is heavier or where facilities exist for helping the cane along. Such places should always be able to maintain a class of cane in keeping with their conditions. The question to be considered is whether they are at present growing a good enough class of cane. Similarly, the position on those estates where irrigation is possible requires further consideration. To irrigate a cane which can hold its own without irrigation invariably increases the yield—but it is an open question as to whether you are getting as full a return for your money as if you were dealing with a cane which had a higher sucrose and a lower drought resistant ratio—because it has already been clearly shown that the optimum cane requires optimum treatment, and resistance and hardiness are not factors which march hand in hand with high sucrose and a low fibre ratio—the two essentials of a big sugar producer.

The final review therefore shows us that we still lack the essential high tonnage, early ripening cane for October-November crushing and that such a cane is not yet in sight, while Co 214, the present cane, is unable to hold its

ground with free growers unless it receives a premium and is grown in sufficient quantity to give the mill a clear run. Co 213 and Co 210 have both succeeded, but the tendency is to ensure a crop by growing Co 210 on any lands which are affected by short rainfall, and thus Co 210 is gaining ground from Co 213 which still, however, remains the stock cane. Co 205 grows on and has proved an excellent cane for the special conditions it was given out for. The mills are therefore assured of a big crop in mid November-December and it is the six weeks' early crushing which is still to be provided for.

So much for the agricultural side of the shield. Let us now see what has been done on the manufacturing side and how this can assist us in the solution of the agricultural problem. When the Sugar Committee toured India in 1920, the average mill efficiency was about 6 per cent. sugar on cane. It is now in the region of 8·5 per cent. Now, excluding canes like Uba which are a trouble from the crusher *to the crystallizer*—the average cane parts with its juice at the mill and from there may be considered similar to all other equally ripe canes in the hands of expert sugar boilers handling proper sugar house equipment. All the actual mill is concerned with is the smashing up of the fibre of the cane and the extraction of the maximum juice. Modern improvements have now produced milling outfits which are simply wasting money in crushing canes like Hemja. This sounds a revolutionary statement, but a close examination of conditions will show what is meant. It is essential for a mill to obtain the maximum amount of cane tonnage it can work to enable it to keep down its overhead and increase its efficiency (*in the past short cane supply and irregular working was responsible for bad figures just as much as bad work*), and the low tonnage of Hemja and similar canes is liable to keep such a plant working short time and thereby increasing overhead charges and preventing the earning of a decent profit. It is no exaggeration to say that at least one mill in North Bihar, crushing a big crop this year, would have been obliged to close down if it had crushed nothing but Hemja. *It could not have obtained the necessary tonnage on the area from which it drew its supplies to enable it to work at a profit.* On the other hand, if a plant has increased its milling efficiency to such a degree that it is able to deal equally effectively with higher fibre canes, it at once will find itself supplied with a big crop of cane willingly grown by free growers with a far greater seasonal range than that provided by local low fibre canes. The immediate success of Co 210 and Co 213 is the proof of this. Now good sucrose content, low fibre and heavy tonnage are a trio which are found in a good many thick canes, but it is a curious but none the less existing fact that the higher the sucrose content in non-tropical canes, the worse the agricultural performance seems to become, and the higher the fibre content as a rule, the stronger grower the cane becomes—*but it does not follow that the higher the fibre content becomes, the lower the sucrose*—the sucrose merely becomes harder to extract.

When we take into consideration these factors, we at once see that if hardiness and good agricultural habit are linked to high fibre content, it is obvious that any really early ripening cane of this class will of necessity have to be a hardy cane of high tonnage with only one point against it—high fibre. Without this it cannot grow the tonnage under unirrigated conditions. This cane, it must be remembered, has got to grow tonnage and ripen off to a high purity in five months or less, besides keeping itself alive on the residual moisture for the preceding three months—a period during which hardly any noticeable top growth can be made. Such demands on an early ripening cane are made by no other cane country in the world and this is why the production

of such a cane involves such difficulty. It must have exceptional vigour or it cannot produce the tonnage in the time, and without a high fibre content I do not think we can get the necessary vigour allied with the early ripening. Now we have already shown that without tonnage we cannot hope to get any early cane grown and it has already been demonstrated that in the case of the present fibre ratio of Co 213, really early ripening and heavy tonnage will not correlate. It would therefore appear to be the best solution to equip the mills to deal even more effectively with fibre and then proceed along this path towards an early ripening heavy tonnage cane.

In the past we were limited by milling efficiency. Co 214, which is now dealt with by the mills without trouble, required considerable attention when first put through, but there is no doubt that the 14 and 17-roller plants now working, if equipped with shredders or knives, can deal even more efficiently with a large tonnage of high fibre canes. *An expenditure of a given sum on knives or shredders would bring in an immediate return, while the same sum would not guarantee a low fibre high tonnage early ripening cane* Our general conditions appear to demand a higher factor of security on the agricultural side than was accepted in 1922, and I consider that the improvement in the milling has given us a larger margin for securing this factor than any agricultural improvement can in an unirrigated tract.

Now Co 214 at present receives a premium of one anna three pies per maund to compensate for a tonnage drop on Co 210 and Co 213. It also can, if all the other factors are favourable, expect to be off the land by the end of November at latest and these are the points in favour of the grower.

Now the mill can get 9·25 per cent. out of this cane with early crushing in a sulphitation plant or 9·5 per cent. if worked by a carbonatation factory. This is excellent work for the commencement of a season showing almost the season average at the start. The sucrose of Co 214 is undoubtedly high, and such high sucrose is, as is generally recognised, not a factor which goes hand in hand with good agricultural habit. It therefore becomes obvious that if we turned to a cane with lower sucrose and early ripening, out of which the mill could start with say 8 per cent., we might reasonably hope to get a higher tonnage cane, as we should be working with a group of seedlings whose lower sucrose content might reasonably be hoped to be linked with a better agricultural performance, the early ripening factor being maintained. A 17-roller train with knives would deal effectively with such a cane, given that its fibre was not over 20, while a mill with a shorter train and knives could at least expect an improved result. Under such circumstances we should then find ourselves in a position far more satisfactory for all parties, i.e., with an early ripening cane with which growers were satisfied on a tonnage basis and for which mills would pay the basic rate, early clearing still standing as an additional advantage to the grower, while the mill could reasonably expect to obtain 8 per cent. at a start in a well-equipped and intelligently-operated factory.

It is therefore a matter for earnest consideration how far the mills are able and willing to assist growers in their areas to grow an improved tonnage, early ripening cane. At present, the attempt to link up on these lines has practically failed, and as a result the mills are likely to lose a good mill cane through the inability of growers to face the drop in tonnage so far inevitably linked with a very early ripening cane. The remedy is to remove this tonnage drop—while preserving the other factors—and it appears to me that in this work the mills can assist materially and to a great extent simplify the breeding problem by enabling the range of canes to be enlarged.

The power of the mills to get the best out of any cane has vastly increased since first North Bihar started cane on a large scale. The cane side of the industry has also made a big advance, and the combination of the two has produced a successful sugar industry. We are now faced with a problem where both sides must unite to solve the difficulty. The grower must realize that to some degree he has got to meet the mills over this combination of premium and tonnage and that it is useless asking for the impossible because closure of the mills will be equally harmful to him as an agriculturist, while the mills must do their utmost to increase their efficiency to enable them to deal effectively with the class of cane which climatic conditions force upon the growers. It is no use either side looking to other countries for help. The conditions which have produced this problem are peculiar to India and its solution has to be worked out here. The result will be to the benefit of all concerned and will be another step on the ladder towards making North Bihar a real sugar tract.

Sugar Beet Pulp: Its Value and Use.

By J. K. THOMPSON, N.D.A.,
The Agricultural Institute, Kirton

The by-products of the beet crop are of immense importance to the future of the sugar industry in this country, for the extension of the crop throughout the country, in addition to the question of the permanent establishment of the industry, must depend very much upon the use made of the "tops" and dried pulp. Towards the extension of the industry it is necessary that the possible combination between sugar beet growing and stock farming be established. At the moment the farmers hold too much to the view that beet is a purely arable crop, and must be grown at the expense of the stock carrying capacity of the farm. In strong contrast to this, the real position is that sugar beet and live stock are mutually helpful to one another; and, far from being antagonistic, are capable of strong combination and even of dependence one on the other. This is the position that obtains in the German sugar beet growing areas, where a system much similar to the English four-course system exists, but with sugar beet taking absolutely the place—as the cleaning and replenishing crop of the rotation and as the source of bulky, succulent winter cattle food—that roots occupy in the British system. But in strong contrast to the English root crop, the sugar beet crop provides the German farmer with a cash return from what, in the English system, is a very expensive break in the rotation, from which all the returns must be recovered indirectly, chiefly through the stock fed off on the crop. Sugar beet, through its by-products offers a means of cheapening the cost of winter stock feeding, and in the German system the crop in its turn is dependent on the live stock for the farmyard manure, which is the continental basis of the manuring of the crop. At the same time the utilization of the by-products, directly in the case of the use of the "tops" and indirectly in the case of the use of the dried beet pulp, places an important credit item in the balance sheet, which considerably improves the economic aspects of the crop.

The tops offer a suitable substitute for roots, and this is the use to which this valuable by-product should be put. The dried sugar beet pulp offers a new and cheap concentrate to the farmer, which should be brought into the production rations of animals in substitution for one or other of the more expensive carbohydrate concentrates.

Sugar Beet Pulp.

The dried beet pulp has up to the present time largely been regarded as a substitute for roots in feeding, 1 lb. of pulp being regarded as equal to 8 lbs. of mangolds, or slightly more of swedes. So used, the material is usually fed after previous soaking for about 10 to 12 hours in three or four times its own weight of water. Long and wide experience on the Continent and in America, and newer experience in this country, leave no room for doubt relative to the efficiency and safeness of dried sugar beet pulp, when so used as a substitute for roots. Admitting all this, however, it must be pointed out that this use does not represent its most economical use, i.e., the use which will allow it its greatest scope as a ration cheapener, or give it its greatest weight in the establishment and extension of the industry. Older Danish and American work, and recent work by Dr. WOODMAN in this country, demonstrates that dried sugar beet pulp should be regarded as a carbohydrate concentrate, and that used as such it is of greatest value as a feeding stuff; moreover so regarded it is the cheapest concentrate on the market at the present time.

It is as a carbohydrate food, therefore, that dried sugar beet pulp must be regarded; its protein content is low, its oil content is pratically nil, while it is also very low in mineral matter. In addition to a high carbohydrate content, dried beet pulp has a high fibre one, somewhere between 17 and 18 per cent., but it must be observed that nearly 80 per cent. of this is digestible. WOODMAN shows an albuminoid ratio of 1 : 13·3, and a starch value of 65·5. In the construction of rations containing dried sugar beet pulp, these remarks relative to its composition must be taken into consideration; the pulp must be associated in feeding with foods of high protein and mineral content, particularly if the ration is being constructed for young, milking, or breeding animals.

KELLNER's and WOODMAN's figures show that wet beet pulp, i.e., the fresh material as produced at the factory, has a value of 94; meaning that the availability—the value—of the digestible nutrients in the pulp for production purposes is 94, full value being 100; whereas in contrast dried beet pulp, according to KELLNER's figures shows a value of 78 only, but WOODMAN shows that if the dried beet pulp is fed after previous soaking, or is fed dry in moderate quantities in a good mixture of concentrates, the value will reach 87. As in general practice, where, using dried beet pulp as a concentrate, the material is likely to be fed in association with other concentrates, and so long as the quantity used is not excessive, the material may be fed dry, which after all will, under most circumstances, be the most convenient method. Obviously however, the fresh wet pulp is of slightly more value than the dried pulp under any circumstances, and where the feeder is in close proximity to a factory it is worth consideration, but it is evident that its use must be limited to the immediate factory area on account of carriage costs. Of course the wet, fresh material will not keep under general conditions because of its large water content.

WOODMAN shows that 1 lb. of dried sugar beet pulp is the equivalent of 0·8 lbs. of maize or 0·9 lb. of barley. In these quantities it should be brought into the production ration for ruminant animals in replacement of such more expensive feeds. WOODMAN's work refers to ruminant animals, but there is evidence that pulp has pretty well the same value in the case of pigs. The writer has fed sugar beet pulp to fattening pigs in substitution for barley meal lb. for lb., using up to 20 per cent. of pulp in the rations, with great success, effecting a useful reduction in the cost of production of 1 lb. of live weight increase. The material is also of use for horses and likewise for poultry.

Generally speaking it will be found most convenient to feed the material in the dry form to cattle, sheep and horses, and the writer has found that pigs take the material better when fed dry than when fed in a wet mixture. When using the dried pulp, without previous soaking there arises the fear of the animal " blowing up," due to the swelling of the pulp after consumption, this condition being the more likely to occur in the case of the horse and the pig, than in that of the ruminant. The writer has found no trouble arise with pigs, but he has evidence of serious trouble having arisen with horses after rash feeding of dried pulp to them.

A little more attention might be drawn to the comparative cheapness of dried beet pulp. It may be purchased on the open market at £5 10s. per ton, free on rail, while it costs the beet growing farmer £5 per ton up to the amount upon which he has an option. This compares with maize meal at £10 15s. and barley meal at £10 per ton, free on rail prices. These prices represent a cost per unit of starch equivalent in the case of beet pulp to 1s. 6½d., in the case of maize meal to 2s. 6d. and of barley meal to 2s. 8d. These comparative starch equivalent prices supply the real criterion as to the relative cheapness of the foods in question, being based on their nutritive values.

In the table of Farm Values for February in the *Journal of the Ministry of Agriculture*, dried sugar beet pulp is shown to have a value on the farm, calculated on actual food value, of £8 10s., to which should be added the calculated manurial value (WOODMAN) of 9s. per ton, making a total value on the farm of £8 19s. Obviously dried beet pulp is a very cheap carbohydrate concentrate. Attention is finally drawn to the most valuable articles on Dried Sugar Beet Pulp, recently published in the *Journal of the Ministry of Agriculture*, for October, November, December, 1928, and January, 1929, under the heading " Notes on Feeding Stuffs," written by Dr. WOODMAN.[1]

Beet Technical Notes.

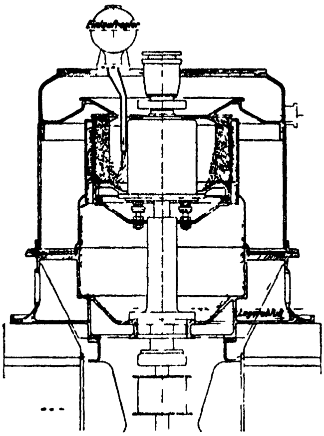
A Continuous Centrifugal.—Following the recently published account of experiments by BERGÉ on the drying of carbonatation scums in centrifugal machines,[2] attention is now called to the possibilities of the machine invented by Dr. GUSTAV TER MEER, of Munich,[3] by means of which the sludge from sewage plants can be dried in a continuous and automatic manner.[4] Filling, drying and discharging are each done without altering the rate of revolution of the drum, and without any help from workmen, other than the usual supervision and oiling. Operation consists of the following four stages, which are continuously repeated : (1) Running in the muddy liquid with closed drum, and the commencement simultaneously of drying ; (2) completion of drying to the desired water content, and covering with wash-liquor ; (3) throwing out the dried sludge from the drum by forcing down the mantle of the drum by oil pressure ; and (4) forcing up the mantle again by oil pressure, thus closing the drum, and again commencing filling.

This method of centrifuging has been working constantly for the past 10 or 15 years in clarifying plants for waste waters in the towns of Hanover, Frankfort-on-the-Main, Harburg, and elsewhere. Machines having drums 900, 1100, and 1800 mm. (35½, 43½ and 71 in.) in diameter consume 12, 20, and 45 H.P. The duration of a cycle of operations (numbers 1 to 4, as above)

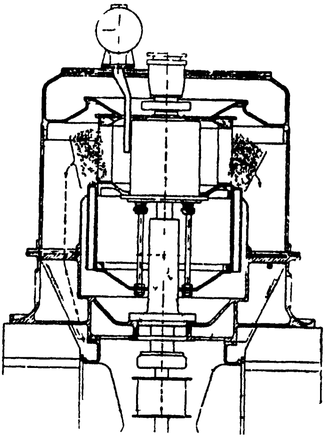
---

1 See *I.S.J.*, 1928, 593, for a summary of these articles.
2 *Sucr. Belge.*, 1928, 48, 69-70. 3 *I.S.J.*, 1921, 585 ; 1922, 446.
4 *Centr. Zuckerind.*, 1929, 37, No. 8, 71-72.

lasts 4 to 5 min., and the machine runs continuously day and night. Only one attendant is required for a battery of 4 to 10 machines. A machine having an imperforate drum of 900 mm. (35½ in.) is capable of dealing with 6 to 10 cub. m. (211 to 353 cub. ft.) of town sludge having 2 to 7 per cent. of



Charging.



Discharging.

solids, 82 to 95 per cent. of the water in the sludge thus being eliminated. It appears a matter of great interest to consider the adaptation of such a machine in the sugar industry.

Steam Consumption.—An Italian engineer, writing under the name of GINO CARBONI,[1] presents the accompanying steam consumption table[2] in kg. per 100 of roots for one of the factories in his country which slices 6000 dz. (600 metric tons) per day, and turns out white sugar and molasses (less than 53 true purity). The total H.P. in the example amounted to 399·4 ; the pressure of the live steam was 7 atmos. at 164°C., and that of the exhaust 1·7 atmos. Boiler heating surface, 1505 sq. m.

Thus the total consumption is 33·46 + 20·68 = 54·34 kg. per 100 kg. of roots. Further average data are : Cardiff coal consumption, 7800 cal., 5·6 per cent. ; water evaporation, per kg. of fuel, 9·72 kg. ; temperature of the boiler feed water, 111°C. ; temperature of the main flue gases, 201°C. ; economizer surface, FAIRBAIRN type, 1505 sq. m. But the present consumption could be reduced in various ways, for example by replacing the 1st body vapour for the heating of the 2nd product pans by 2nd body vapour, by increasing the h.s. of the thick-juice heater and the thin-juice boiler, thus realizing altogether a saving of 2·44 kg. per 100 of roots, equivalent to 0·25 per cent. of coal on the same basis.

De Vecchis Process.—One of the advantages claimed for beet dehydration processes is the high purity of the extraction juice, owing to the albumins remaining behind in the exhausted slices. This, of course, raises the fodder value of the pulp obtained. It seemed very desirable to Dr. O. SPENGLER and W. PARR, of the Institute for the German Sugar Industry, Berlin,[3] to examine this point, a rather important one from the point of view of processes such as those of DE VECCHIS and OWEN, in order to ascertain to what extent the albumins are rendered insoluble as the result of heating during the drying process. Accordingly, 10 kg. of beets were sliced, well mixed, divided into two parts, and one part dried to a water content of nearly 4 per cent. on

1 *L'Industria Saccharifera Italiana* ; through *Die deutsche Zuckerindustrie*, 1928, 53, No. 47, 1327.
2 See page 210.
3 *Zeitsch. Ver. deut. Zuckerind.*, 1928, 796-800.

STEAM CONSUMPTION DATA.

Part of the Plant.	Heating Surface and other Data.	Direct Steam.	Exhaust.	Vapour from Evaporator Bodies 1st.	2nd.	3rd.	4th.
Mechanical Work	399·4 H.P.	1·92					
Radiation Losses		1·39					
Diffusion Battery	14 at 40 hl	3·74					
Raw J. Heater No. 1	30 sq. m.						1·66
,, ,, No. 2	30 sq. m.				7·02		
Heater before 2nd Carb.							
Heater before 2nd Carb.	30 sq. m.				1·39		
Heater after 2nd Carb.	30 sq. m.				1·92		
J. Heater	30 sq. m.				1·22		
Thin J. Boiler	30 sq. m.	2·22					
Thick J. Heater	20 sq. m.		0·17				
Body for J. Heating			2·22				
Ditto for Evaporation		18·84	17·39				
2nd Body				21·99			
3rd Body					10·44		
4th Body						10·44	
To Condenser							8·78
Solution of Low Sugar		0·31					
1st Prod. Vacuum	156 sq. m.		1·00	10·77			
Green Syrup Heater		0·22					
2nd Prod. Vacuum	190 sq. m.			3·56			
1st Prod. Centrifugals		3·80					
2nd Prod. Centrifugals		0·57					
Pan Save-alls		0·13					
Filter-presses		0·13					
Ammonia Draw-off Tubes		0·10					
Schiff & Stern Apparatus		0·09					
Total		33·66	20·70	36·32	21·99	10·44	10·44

tin trays. Then both the dried and the fresh slices were extracted in the laboratory in an apparatus consisting of three vessels (each of about 350 c.c. capacity) connected in series, using water at 75-80°C., and continuing washing in both cases until the liquid issuing from the last vessel had only 0·4 per cent. of solids.

Working in this way, balance sheets were constructed for the total nitrogen and the albumins, and the following results obtained. *Total nitrogen* (*a*) remaining in the fresh slices, 50·2 ; and (*b*) remaining in the slices which had been dried, 57·8 per cent. *Albumins* (*a*) remaining in the fresh slices, 74·3 ; and (*b*) remaining in the slices which had been dried, 92·3 per cent. These results confirm what one would expect, namely they show that the content of the exhausted slices in nitrogen compounds, especially in albumins, i.e., proteins of high food value, is raised as the result of drying to a not inconsiderable extent. Although these laboratory experiments did not duplicate actual factory conditions very closely, seeing that diffusion was not applied, only a process of washing the slices with hot water, probably the results which would actually be obtained in practice would not be very different.

Continuous Filtration.—At the Abscon sugar factory, North of France, a continuous filtration plant has been installed for the juice coming from the first carbonatation, a description of which plant and its working has been contributed by Mr. EM. SAILLARD, Director of the Laboratory of the Syndicate of Sugar Manufacturers of France.[1] At this factory they slice 900 metric tons of roots in 24 hours. After liming the juice at the rate of 2·5 kg. per 100 kg. of beets, (adding the reagent in the form of milk), the first carbonatation is carried out continuously in a tank in which the juice has a height of 3·5 metres, the gas being introduced into it through two DELEBARRE distributors, all of which works very well. As for the continuous filtration installation, this consists of : (1) PHILIPPE filters, of special construction ; and of (2) rotary vacuum filters.

This latter has the exterior form of the well-known PHILIPPE syrup filter with this difference that in place of being flat and of containing a flat metallic frame-work, it is cylindrical, and contains a round metallic framework. Filtration proceeds from the exterior to the interior of the bags, the juice leaving through a pipe closing the top of the bags. In the process of filtration, the interior of each bag is connected by means of a pipe alternately with a vacuum pipe and with an air compressor. This change of pressure is made every 12 min. and 4 secs., being 12 min. under vacuum and 4 secs. under pressure, the former inducing filtration, and the latter separating the scums on the outside of the filter-cloth. Actually the course of operations is to mix up the muddy unfiltered carbonatated juice by a helix, to pump this into the rotary filter, and then to send this filtrate as well as the wash-waters through the Philippe, the filtrate from which goes to the evaporators. Mr. SAILLARD remarks that the installation and its operation impressed him well.

Beet Seed Disinfection.—Due to the abnormally cold weather in the spring and early summer of 1928 beets were much attacked by root blight. This induced the writer, Dr. MENKO PLAUT, who is Director of seed selection to the well-known firm of August Knoche-Wallwitz, of Hamersleben, Germany, again to examine the merits and otherwise of seed disinfection. He points out preliminarily that views vary in regard to this question, and while in Germany opinion is not in general in favour of it, on the other hand in Holland and Denmark very satisfactory results have been obtained by uninterested workers. He believes that the condition of the soil plays a more important

1 *Suppl. Circ. hebd.*, No. 2079 of 1929. 2 *Centr. Zuckerind.*, 1929, 37, No. 2, 39-41.

part than is usually suspected, though it is not only liming that prevents this disease. He has therefore carried out experiments with treated and untreated seeds sown in different soils, and has obtained results that certainly appear to prove the value of the treatment. Here, for example, are the figures of a field test, using about 200 ztr. of seed :—

Plot	UNTREATED Total No. of Beets	Attacked by Blight. No.	Attacked by Blight. Per Cent.	DISINFECTED Total No. of Beets	Attacked by Blight. No.	Attacked by Blight. Per Cent.
1	383	35	9·15	452	2	0·44
2	356	25	7·00	629	1	0·16
3	372	13	3·50	281	2	0·69
4	388	9	2·32	318	0	0·00
5	390	1	0·25	401	1	0·00
Mean	378	16·6	4·44	415	1	0·25

To quote from another series of the many cultivation tests made by this investigator, the following were the number of plants counted in plots of the same area with different treatments : Untreated, 460 ; soaked in water only, 548·5 ; treated with "Germisan," 0·25 per cent. for two hours, 726·5 ; soaked in "Uspulun," 0·25 per cent. for two hours, 703. All these results seem very much to favour the disinfection of beet seed before sowing by soaking it in a solution of one or other proprietary preparation.

Java Technical Notes.

EVAPORATION UNDER HIGH PRESSURE. **P. Honig and J. F. Bogtstra.** *Archief, Mededeelingen*, 1928, No. 8, 377-441.

Experiments were carried out in Java carbonatation and defecation-sulphitation factories, using an evaporating apparatus consisting of three semi-Kestners, each fitted with one tube, this plant being placed parallel to the ordinary vacuum quadruple of the factory. The highest temperature of the juice was 115°C. in the first body, and 102°C. in the 3rd, the duration of the passage of the juice being nine minutes, and the final density 50°Brix. It was found that the sucrose and glucose (reducing sugars) decomposed in pressure evaporation were not greater in the defecation-sulphitation process than ordinarily, nor was the increase of colour greater, that is, when the *pH* was the same in both cases, or approximately so. In carbonatation with slightly acid juices the sucrose decomposition probably was slightly more in pressure than in vacuum evaporation, though there was no alteration in the character of the colour, nor in its intensity. But the great disadvantage to pressure evaporation was shown to be the greater amount of incrustation caused, which in defecation-sulphitation was so considerable as seriously to lower the capacity of the apparatus. In the carbonatation factory the increased incrustation was not really serious, but the syrup obtained was unusually cloudy. High pressure evaporation, if it is to be applied, will make it necessary to have a more rapid circulation of the juice than obtains in the present day evaporator, and the fixing of an exactly limited *pH* will also be necessary. Part of this article is taken up with a useful survey of pressure evaporation, the first mention of which is attributed to RILLIEUX in 1883, when he prescribed a temperature of 100°C. for the last body of the effect. But it was Prof. P. MEYER of Delft, Holland, who, on the ground of steam-economy calculations, found in 1902 a method of working which he then definitely called "pressure evaporation."

USE OF MOLASSES FOR SOIL IMPROVEMENT. **A. C. van den Bijllaardt.** *Archief*, 1928, **36**, II, No. 37, 958-961.

Dr. O. ARRHENIUS not long ago[1] concluded from pot tests that " addition of molasses exerts a harmful effect in sand as well as in clay." This may be so when the addition is made shortly before or after planting ; but, provided the molasses is added in suitable quantity and at the right time, it has a favourable effect, not only on light but also on heavy impervious soils, due largely to its power of modifying their structure, micro-biological processes taking place in the presence of the large amount of organic matter, which greatly increase the content in colloidal constituents. Field tests, made on *rantja-minjak*, that is, a very heavy, difficultly worked soil, comprised treatment with molasses in 1925 on the basis of " ¾ tin per geul " before the West monsoon, putting under water, and " after some time " planting with paddy. After this crop the soil was superphosphated, and planted with EK 28 cane. A strikingly better result was obtained, compared with the same soil untreated, the yields both of cane and of sugar being much greater, though it is true the purity of the juice was lower (85·6 against 88·0°). This generally favourable result is parallel with the experience of J. GROENEWEGE,[2] and the author suggests that field trials should be made by others to confirm it.

DRYING AIR. **W. F. Alewijn.** *Archief*, 1929, **37**, I. No. 2, 39-54.

Treatment of air so as to lower its water content has significance in the first place for the sulphur ovens, and secondly for the bagging and storing of sugar. In practically every factory the desiccant is unslaked lime. In many factories the apparatus in which it is contained consists simply of wide iron pipes having covers at both ends. Or it may consist of a vertical shaft open beneath, which is filled with lime from the top, the air entering at the bottom, from which from time to time the spent lime is drawn off. A dryer measuring 275 × 24 cm. charged with 150 kg. of unslaked lime, through which 4 cub. metres of air was passed per min. reduced the water content of the air from 53 to 48·3 per cent. at 31°C., thus removing only 10 per cent. These results show that the effect of the lime in the quantity used is small. But there is another means of reducing the water content of air, namely by compression (when it is precipitated), the air obtained on subsequently expanding containing a relatively lower moisture content than originally. Average factory air containing at 31°C. 68 per cent. of water, i.e., 21·6 grms. of water vapour per cub. m., was compressed to 5 atmospheres over normal ; and on being released to ½ atmosphere was found to contain 5·3 grms., or when compressed at 11 atmospheres, 2·6 grms., that is a reduction in the water content of 75 and 88 per cent. respectively. Simple cooling to 0°C., using a refrigerating machine, will reduce the water of the atmosphere to 15 per cent. relative humidity. Take, e.g., a sugar store for 100,000 bags occupying 10,000 cub. m., with a free space of 4000 cub. m. ; its air has a relative humidity of 92 per cent. at 32°C., equal to 30·8 grms. of water per cub. m. To reduce this to 18·7, therefore, 12·1 grms. must be removed, and it is assumed that once every 8 hours the air of the store is renewed, equal to 500 cub. m. per hour, or 8·3 per min. If compression is to be used, an absolute pressure of 2·5 atmospheres will be necessary, and this will cost 32 H.P. On the other hand, if cooling is to be the system to be applied, then the H.P. required for the refrigerating machine will be 5½. Cooling, therefore, is distinctly the cheaper method for practice ; and once the air in the store has been filled with dry air it should be provided with a slight pressure of air so as to keep the moist air outside.

1 *Archief*, 1927, Afl., 31, 791. 2 *De Indische Mercuur*, November 24th, 1926.

KEEPING QUALITY OF WHITE SUGARS. **P. Honig.** *Handelingen van het Tiende Congres; tweede gedeelte Veralsg*, 70-87.

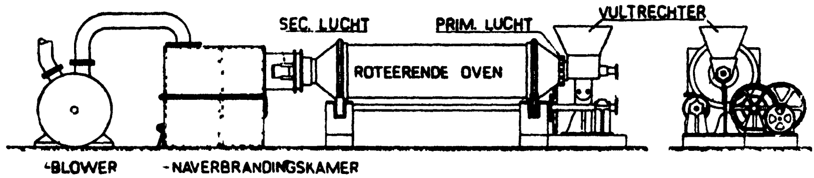
At the 10th Congress recently held in Java, Dr. P. HONIG, Chemist of the Experiment Station, dealt with the causes of the deterioration of sugars, especially white sugars. Keeping the water content low is one of the most important precautions to be taken. Sugar should leave the centrifugals with at most 0·6 per cent. of water, otherwise a dry product will not result unless it is put through a dryer using a sufficient temperature. On leaving such an apparatus, it should be allowed to cool in a sieving installation so that it comes into contact with the atmosphere at its prevailing water content. Either Java sugars must contain a lower invert sugar content than is so just now, or the latter part of some factories must be otherwise designed than at present. The drying and sieving plant must be installed separately, and not situated in an atmosphere saturated with water. In this department the control of the moisture of the air is as desirable as in the store. Another point dealt with was the alteration of the colour of sugar on keeping, and in the case of whites this would appear to be due to the SO_2 in the layer of syrup becoming oxidized. Some S.H.S. sugars which had become coloured after six months were found to contain the following percentage amounts of SO_2; 0·00162, 0·00104, and 0·00213, whereas others which remained unaltered in colour were practically SO_2-free. Moreover, it was observed that S.H.S. sugars with high invert content always coloured more on keeping than others low in this constituent. Water, invert and acidity are the three most important factors controlling the keeping qualities of sugar, and of these the most important is the *pH* or acidity. Micro-organisms have been over-emphasized in this respect and probably also the water content.

SYRUP FILTRATION IN MAKING WHITE SUGAR, USING KIESELGUHR. **T. van der Linden.** *Verslagen der Vereeniging van chemisch, technisch, and landbouwkundig adviseurs*, 1928, Afl., No. 4, 170-175.

At the Garoem s.f., syrup as it came from the evaporators was clarified by the Bach process, and a purification resulted which is described as excellent. But the cost was high, and much frothing occurred. A simpler, cleaner, and if possible cheaper method of working was therefore sought, to which end "Hyflo-supercel" was given a trial. First the cloths of Kroog presses were "precoated," after which the syrup, previously heated to 85-90°C., and mixed with a smaller quantity of the kieselguhr, was pumped through the filters. Sweetening-off was not attempted, the cake obtained being sent back to the mud resulting from the settling of clarified juice. In these tests the consumption of kieselguhr was found to be about 1·1 per cent. Using Sweetland presses, and a larger filtering area, it was found possible later to lower this to about 0·6 per cent. Working thus, an excellently clear filtrate was obtained, and it was also distinctly lighter in colour than that obtained with the Bach process, though it failed to show the same increase in purity (87·1 to 87·6 as compared with 87·8 to 98·0). Still there was no frothing and so long as the amount necessary did not exceed 0·85 per cent. of the Brix or 0·12 per cent. of the cane there did not seem to be much between the two as to cost. Actually, however, the reason why kieselguhr working was not adopted at the factory named appears to be the lower increase in purity it realized (i.e., 0·5 compared with 1·2). True, the increase in purity effected by the Bach process (87·4 to 88·7) was unusually high, and it is likely that had the tests been carried out in another place the conclusion might have been otherwise, namely that kieselguhr working, in addition to the several other advantages proved, also possessed some economy compared with the other.

ROTATING SULPHUR OVENS. **W. F. Alewijn.** *Archief*, 1928, **36**, I, No. 20, 465-468.

Disadvantages attached to the usual sulphur oven, such as difficult burning of some kinds of sulphur (especially the impurer grades containing a little bitumen), subliming, and small capacity, have induced a certain company in America to design a rotating apparatus free from such defects, namely one having a rotating combustion chamber, something like a sugar dryer, or a lime-slaking apparatus. Ovens of this kind effect the mixing of the molten sulphur, so that ash constituents and bituminous substances which may be present are prevented from forming a film preventing the proper burning of the material. Combustion takes place on the surface of the molten sulphur, and on the wall of the rotary kiln, part of the sulphur being carried round, and another part falling in drops during the



Vultrechter, filling funnel; *prim. lucht*, primary air inlet; *sec. lucht*, secondary air inlet; *naverbrandingskamer*, secondary combustion chamber.

rotation of the drum, by which means the surface over which combustion may take place is greatly increased. In the figure is shown the scheme, the rotating part making ½ to 1 rev. per min; while the sulphur is introduced through a trap in the funnel, or by way of a pipe heated by steam. Air is admitted for combustion at a point between funnel and oven; while the outlet from the oven opens into the secondary combustion chamber, which is filled with refractory material, the air for which enters through a damper. Lastly, after the secondary combustion chamber is the blower which presses the SO_2-containing gases through a cooler to the place of use. Ordinary undried air is used for the combustion, but for the sugar manufacturer this probably is not without danger in respect of the formation of sulphuric acid (SO_3). So far this new type of sulphur oven has not been installed in Java, but it has been introduced into beet factories and refineries in the U.S.A.

Trade Notices.

SENTINEL VALVES.—From Messrs. Alley & MacLellan, Ltd., of Worcester, we are in receipt of a Catalogue (W.2) solely devoted to describing Valves for sugar plants. This firm lay themselves out to supply every type of valve needed in cane and beet sugar factories, having made a special study of valve working conditions for juices and syrups, and they frequently supply factories throughout with valves, while they have supplied complete valve equipment to 90 per cent. of the beet sugar factories in Great Britain. Amongst the types listed in this 100-page catalogue may be mentioned Rubber-faced Valves designed to give adequate support and guidance to the working parts and at the same time minimize resistance to the flow of the juice; Fullway Wedge Type valves with dermatine faces for cane juice; lead-lined valves (also non-corrosive iron valves) for use with SO_2 and other fluids attacking ordinary metal valves. As for steam and water valves, this firm's experience of over half-a-century as valve specialists should ensure the reliable functioning of all their products. Moreover all "Sentinel" valves are guaranteed. Those interested should apply to Messrs. Alley & MacLellan, Ltd., for a copy of this catalogue, which gives dimensions and prices of valves described.

The Brazilian Sugar Industry.

Department of Overseas Trade Report.

In the five-year period 1880-84 Brazil exported an average of 226,500 tons of sugar annually. Twenty years later the trade had declined to less than a quarter of that amount. Since the War the industry has revived and the 1927-28 crop, though considerably smaller than the year before, still exceeded any other recent year by a large margin ; but owing to the unsettled financial condition of the industry in 1927 steps were taken on the initiative of the Bank of Brazil, to which many of the Campos mills were heavily in debt, to establish a sugar valorization scheme which has since been taken up and developed by the producers of Pernambuco. This policy has been successful, under cover of the high tariff, in maintaining local prices at a figure far above the world market price. Under these artificial conditions the bulk of the production is sold in the country, a minimum of 15 per cent. being exoorted for the purpose of keeping up the domestic price. It was authoritatively asserted recently that if the numerous small mills were " disindividualized " and substituted by large central undertakings, no other country could compete with Brazil in sugar production.

The Bank of Brazil took the keenest interest in maintaining prices in the home markets in 1927-28 and arrangements were made with every producing State in the Union whereby the factories sold their sugar at a stated minimum price through a local committee or " Convenio." The bank, in the event of the price falling below 50 milreis (say 25s.) per bag for white crystals, was prepared to warrant sugar at 30 milreis per bag until such time as prices should improve again. The bank also stipulated that the estimated surplus of sugar in the country should be exported abroad, and the State of Pernambuco exported 22,979 tons, most of which went to London and Liverpool as well as some 3000 tons to Argentina. The policy of the bank proved an unqualified success, and as a result the average price for crystal remained at just under 50 milreis per bag of 60 kilos delivered at stores in Pernambuco.

This experiment having proved successful in maintaining prices in the local market, the Governor of the State of Pernambuco called a convention in June, 1928, of all the sugar-producing States in the country for the purpose of forming a co-operative organization in the place of the " Convenio." This organization is to be managed by seven members chosen from the industry who are to handle sugar of all grades and dispose of same direct to buyers, thus eliminating brokers and other intermediaries. Each sugar-producing State is to have its co-operative society in like manner and with the same purpose in view. The various producing States are to be jointly represented at Rio de Janeiro by a committee that will have sole and exclusive charge of selling the sugar in Rio de Janerio and Sao Paulo. All the States agreed on the *modus operandi*, and there is every reason to suppose that this organization will give the same results, satisfactory to mill owners, as those obtained last crop.

As was to be expected, the consequence of maintaining prices is that planters, not only in this State but also in those in the South of the country, such as Rio de Janeiro, Sao Paulo, and even Minas Geraes, have been encouraged to increase their efforts.

In the State of Pernambuco the 1927-28 crop yielded 225,305 metric tons of sugar of all grades, as compared with 200,460 tons the previous crop, and 193,020 tons in 1925-26. Exports were 25,979 tons, the balance being disposed of in the local Brazilian markets. The 1928-29 crop promises to yield about the same amount.

WELDLESS STEEL TUBING.—The modern weldless steel tube is a very different thing from its prototype of a few years ago. It represents a method of manipulating steel into almost every conceivable shape. In one particular mill no less than 800 different shapes, or " special sections," are drawn, apart from the usual range of sizes in the round. Many of these special sections are used, not as " tubes," but as structural components, being either cut down to specified size or manipulated into any conformation desired. They may be tapered, butted, bent, screwed or tapped, trapped, bulged or reduced, spun, flanged, slotted, domed ; brazed, welded or soldered ; plated, coppered, or galvanized.

Publications Received.

Industrial Carbon. C. L. Mantell. (D. Van Nostrand Company, Inc.; New York). 1929. Price: $4·50.

Elemental carbon in its various industrial forms covers a considerable ground. This book deals with diamonds, graphite, carbon black, lampblack, fuel charcoal, miscellaneous blacks, and also with applications of these, viz., the making of carbon brushes, pencils, carbon refractories, and so on. But for the sugar-man its interest is in two chapters, treating of boneblack and of vegetable carbons, which are full of useful and generally accurate information. These sections give accounts of the nature of these materials, their composition, decolorizing power, optimum decolorizing conditions, and application in sugar refining, including a description of the revivification of "Suchar" by means of the "Windok" furnace. Most of the data have been compiled from American sources, whereas something more might have been said of other work on the subject, and a fuller account given, say, of "Norit" and of "Carboraffin." This latter carbon is stated to be so "decidedly acid" that in practice limestone has to be added for its neutralization, a statement which is probably open to correction. As a compilation of general scientific and technical information on elemental carbon, this book is a very useful one.

Remedy of Unknown Losses in the Sugar Industry. Om Parkash Talwar, B.Sc. (Talwar Chemi Cottage, Chakwal, Jhelum, Punjab, India.) 1928. Price: 1 rupee.

This booklet of 27 pages deals in three chapters with the importance of hydrogen-ion concentration in the sugar industry; with methods of determining this value colorimetrically; and with its practical application in the sugar-house, which ground is covered on the whole both clearly and accurately, while the methods described are evidently the result of laboratory and factory practice. A careful perusal of these lines by those as yet unacquainted with the meaning and application of the *pH* value should show the way to a greatly improved clarification with decreased inversion losses. The booklet has been recommended by the Sugar Technologists' Association of India, and we are sure that it will be found of much value by many sugar manufacturers in that country.

Ready Reckoner and Sugar Accounts Calculator. Compiled by J. D. Khandhadia. (J. D. Khandhadia, Janmastami House, Khetwadi Main Rd., Bombay No. 4, India). 1928. Price: 10s. net.

This is a ready reckoner in sterling and in rupees for the use of sugar manufacturers, brokers, and merchants, whom it should save much time and labour. Quantities concerned are from 1 to 1000 tons, and the values range from ¼d. to 20s. per cwt. on the one hand and from fractions of a rupee to Rs. 18 on the other. In addition to the values calculated directly, it enables one to calculate C.I.F. and F.B.H., making allowance in the former case for 1 per cent. deduction, and in the latter for 3 lbs. per bag. This reckoner appears to have been compiled with considerable care, and its value in saving tedious calculation should be appreciated.

Constitution of Sugars. W. N. Haworth, D.Sc., F.R.S. (Edward Arnold & Co., London.) 1928. Price: 8s. 6d.

Dr. HAWORTH's name is well-known in connexion with experimental work on which the new constitutional formulae of the sugars is founded. Acting on the wish of friends and pupils, he has now prepared an account of such work, this covering almost entirely his own researches and views in this direction. His monograph should be well appreciated by the student of this branch of carbohydrate chemistry, seeing that it collects in a convenient compass a considerable amount of matter which otherwise would be rather widely scattered throughout the literature.

Brevities.

Oil as Sugar Factory Fuel.—According to the Review of the Bank of London and South America, the majority of the sugar factories in Tucuman are now considering the advisability of employing petroleum oil as fuel instead of wood. By this means considerable economy would be effected in the running of the mills.

Bees and Beet Sugar.—D. M. T. Morland, M.A., of the Bee Research Institute, Rothamsted Experimental Station, points out[1] that in bee feeding sugars which contain considerable quantities of impurities may be unsatisfactory when used for immediate consumption at times when the insects can take frequent flights, but for winter consumption even small quantities of indigestible non-sugars accumulate during the rest period and cause dysentery in spring. White beet granulated and plantation white sugar appear both suitable. It is concluded that the prejudice that has existed among bee-keepers against beet sugar has little or no foundation.

Molasses Utilization.—It is possible almost quantitatively to transform the sugars present in cane molasses into lactic acid by a fermentation process involving the following steps[2] : Dilution with water (1 : 1), addition of phosphoric acid to precipitate albumins and calcium salts, neutralization of excess of acid, dilution to about 20° Brix, inoculation at 50° Brix with a Delbrück bacterial culture fermentation, addition of milk-of-lime to render alkaline separation of the precipitate, concentration of the liquid to 50-70° Brix, crystallization—improvement of the syrup obtained, and finally transformation of the calcium lactate by the addition of acid into lactic acid.

Tschauchelwitz Results.—This German beet factory, only 800 tons daily, but very well laid out, was the first to use pressure evaporation.[3] This means that there is practically no vacuum, no condenser, no vacuum pump, the pre-heaters, in particular the first raw juice-heater, acting as surface condensers. The boiling point in the first body is as high as 124°C.. and in the second, 113°C. All pans draw their vapour from the second body. As the result of this system, the fuel consumption is only 5·4 per cent. coal of 11,500 B.T.U. on the beets, raw sugar being only made. This factory last campaign worked 50,000 tons of roots of 13 tons per acre, and an average sucrose content of 20 per cent.

Cane *vs.* Beet Sugar.—In a paper published by the Ministry of Agriculture,[4] appears the following, though by this time one would hardly have thought it necessary again to insist on the identity of sucrose whether obtained from the cane or the beet : "Scientific experiments have been made to see whether there is any difference in the action of the two kinds of sugar in the same operations ; there is found to be none. For instance, there is no difference between jams, jellies and canned fruits made with beet and with cane sugar. There is no difference in the results from the feeding of bees in winter time on cane and beet sugar. Bee-keepers who go to the trouble of obtaining cane sugar in the belief that it is superior for their purpose to beet sugar do so in error."

Firebricks.—Fireclay and other silicious refractory materials, which on test appear to stand up well, frequently behave in a very unsatisfactory manner when built into a furnace, or when used in such a manner that they have to withstand a load at high temperatures. Prof. W. M. Travers, F.R.S., who has studied this subject on the technical scale, states[5] that he has yet to find a firebrick that will stand up under a load of 10 lb. per sq. in., when subjected for six or even three months to a temperature of 1400°C. throughout its whole mass, though it might withstand a much higher temperature in the experimental furnace. An explanation of this behaviour, he believes, is to be found in the rearrangement of the structure of such refractories, by which the ratio of pores and solid particles is altered during the heating.

1 *Journal of the Ministry of Agriculture*, 1927, 35, No. 10, 945-950.
2 Jorge V. Saitcew. *Tucuman Chem. Zentr.*, II, No. 25, 2723 ; *Zentr. Bakt. Parasitenk.*, II, No. 72, 4-21. 3 Dr. Eric Troje in a letter in *The Sugar Press*, 1928, 14.
4 Dated January 30th, 1929. 5 *Chemistry and Industry*, 1929, 48, No. 5, 106-107.

Review of Current Technical Literature.[1]

QUESTIONNAIRE ON CRUSHING PLANTS IN THE PHILLIPINE ISLANDS. **Theo. Nickelsen.** *Committee Reports for the Sixth Annual Convention of the Philippine Sugar Association*, 1928.

Mr. NICKELSEN, Chairman of the Committee on Manufacturing Machinery of the P.S.A. circulated among his friends a very complete questionnaire designed to cover the entire range of operations in the factory, the purpose being to elicit useful practical information from members of the Association on matters to which some have given special study. Mr. NICKELSEN himself returns some very interesting replies, of which a summary is here given.

Q. What constitutes the greatest weakness in the modern 9, 12, 15, and 21-roller plants with single and double crushers operating at peak loads ? *A.* In analysing this question it is resolved into one of capacity, with reasonable efficiency and a reliable guarantee against breakdowns of the moving elements and the consequent loss of time. Outside the lack of adequate measures in maintenance and operation of these moving elements of a modern mill, its inherent weaknesses in erection and arrangement, are, without departing from conventional design, as follows, :—Rollers wearing smooth within a short period when milling to full capacity, resulting in high cost in keeping spares on hand Also there is the difficulty of making these changes, without overstepping the limit of time at the engineer's disposal. Scrapers are also a source of trouble, especially where the lift of the top roller exceeds one half inch or more. In most of the mills in the P.I. the scrapers are attached to the mill housing, and the scraper and bar do not move with the lift of the top roller, consequently the setting-up bolts have to be abnormally tightened to give sufficient spring to the scraper plates for the scraper toe to follow up the roller when it lifts and keeps firm contact. This defect is eliminated in some of the later designs of mill by attaching the supports of the scrapers to the top roller brasses or to the C.I. holders for these. The materials for scrapers might be improved upon by making them of a texture less liable to need replacements. Cleaning scrapers for the Messchaert juice grooves are very susceptible to wear. Also, after a few seasons, the grooves themselves are worn very wide and a great part of the effective crushing surface of the roller is destroyed. This is caused by the scrapers, bearing first on one side, then on the other of the grooves in the rollers. This might be overcome by designing a heavier and more stable bar to hold the scraper blades, which itself should be supported by heavier setting-up bars to prevent side spring and de-alignment of the blades. One of the weaknesses in mills of this day is the transmission of motion and power from the prime movers to the crushing machinery. The gearing, as designed in the early history of the cane sugar industry, remains the same to-day with very little change beyond strengthening details of construction such as, replacing the old C.I. gear wheels and pinions by cast steel rims, and in later design by substituting an all-steel construction of rim, spider and hubs. In milling to overcapacity, as gauged by Philippine standards, the gear shafts, gear teeth, hubs and spiders are often inadequate to the work. Due to low speeds the torque found in transmitting the large horse power from the engine shafts to the mill rollers is very heavy, and when to this is added overcapacity operation, ranging from 25 per cent. to 75 per cent. in tonnage and speeds, it is easily seen that the factor of safety in the design of both the gears and mill pinions must necessarily be greatly narrowed, and in many cases, especially at the gear drives for first mills and crusher rollers, the safety factor disappears altogether. In a twenty-one-roller train preceded by knives and crushers there is very often a condition that obtains at some time during the season's run that tends to offset the work of this multiplication of rollers. This condition is found in the usual wear and stretch of rollers, bolts and housings, etc., that may, and will, cause one or more of the three-roller units in the train to be working at a much lower rate of efficiency than the others. On making a dry test of a mill with fifteen rollers, the author has found that constant vigilance was necessary to insure each mill's working to capacity and to maintain an even distribution of the load throughout the working train of mills. If we had some means of automatically recording a constant load

[1] This Review is copyright, and no part of it may be reproduced without permission.—Editor, *I.S.J.*

factor on the moving blanket of crushed cane passing between the rolls of each unit this would assist us greatly in keeping the efficiency of the total train of mills up to its highest pitch. In looking over the various shapes and settings of returner bars in use in Hawaii, Java and the Philippines it is seen that there is still a wide variant for doing practically the same work. Certain classes of cane in variety and structure demand different mill settings, yet still there are wide differences in the various mills, in the same countries, working up similar canes, as also wide variants in different countries working up cane of little dissimilarity. This variant, or difference, in settings of mills, scrapers and bars, is not nearly as much as it used to be. Still it is sufficient to strike the observer that the mystery of the returner bar and mill settings has not yet been thoroughly solved.

Q. What causes have you found that make to the greatest number of stops during a milling year and what remedies would you suggest? *A*. The loss of time in the past four years, taken from the records of a few of the larger modern centrals, is found in scraper troubles, revolving knife cane jambs, breakage of mill couplings, mill shafts, gearing shafts, and returner bars and very often cane jambs at the crusher or one of the succeeding mills. A very nearly negligible loss of time is now noted under the heading of intermediate conveyor breakages, which in former days was a great source of trouble. Also chains and bucket attachments, juice strainer and bagasse elevators, formed a major part of the total time loss. In addition to these, the cane unloaders, intermediate conveyors, gearing spider hubs, and belt troubles of the old type of cane knife drives, predominated in the delays of a decade or two past. As leading causes this past year, one finds scrapers, chains, including intermediate conveyors, juice strainers, breakage of couplings, gear shafts, gears, the roller groovings wearing smooth causing cane jambs, cane knives, belts, cane unloader, cane car derailments, and some few instances of low steam. "No cane" may be chargeable to the transportation department or to the *hacenderos* not loading; but often to out-of-balance operation in the factory. Stops as enumerated have been partly rectified now by better operating methods, strengthening or improving design of the moving element in question, and greater commonsense care of our lubrication. Scrapers have been strengthened and redesigned for improved service; chains have been made heavier, and in some cases these have been eliminated and gear, or direct drives, substituted; conveyors have been altered to suit conditions and give increased efficiency. In one instance the moving element of the conveyor was raised, using the chains and slats only to press on the surface of the bagasse, making a real drag, instead of attempting to convey, inadequately, by filling up the space between the bottom plate and the width of the angle by the bagasse, or the semi-crushed cane. In other words, the angle-iron slats no longer dragged along the bottom of the conveyor but rode a distance of 3 to 8 in. clear, allowing the bagasse to slide along the plate with the conveyor chains, sprockets and slats resting on the top, their combined weight pressing on to the blanket and moving in the direction to the next mill causing the material to slide, with but little friction and without cluttering up the chains and sprockets with loose bagasse and pieces of cane.

DETERMINATION OF SULPHUR DIOXIDE IN SUGAR, USING THE SULPHIDE STAIN METHOD. **J. M. Bryan.**[1] *Analyst*, 1928, **53**, 589-590.

The following modification of J. S. MANN's "sulphide stain" method[2] has been found to be extremely sensitive:—The apparatus, which is similar to that used in the GUTZEIT test for arsenic, comprises a tall glass bottle of about 150 c.c. capacity, into which is fitted by means of a waxed cork a tube (15 cm. by 12 mm.), having a constriction about one-third of the distance from the top, to receive a plug of cotton wool. This tube is also provided with a waxed cork through which passes a tube (15 cm. by 5 mm. bore) constricted 7 cm. from the top to retain the test slip in position. The lead acetate test papers are prepared by soaking English filter-paper in a 25 per cent. solution of neutral lead acetate, drying them in air, and then cutting them into strips (6 cm. by 4 mm.); these strips are kept moist by placing them in a

[1] Food Investigation Board of the Department of Scientific and Industrial Research, Cambridge.
[2] See Ogilvie: *I.S.J.*, 1926, 644.

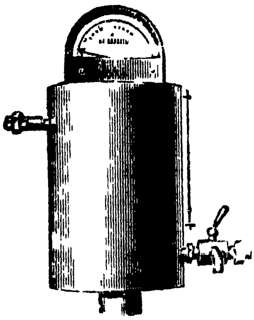
desiccator in which the usual dehydrating agent is replaced by wet pumice. After each test the lower tube should be dried and a fresh plug of cotton wool inserted. In making a test 25 grms. of zinc pellets (free from sulphur) are placed in the bottle, and washed with dilute hydrochloric acid, followed by air-free distilled water. The zinc is covered with 50 c.c. of air-free distilled water, and the sugar sample introduced. 50 c.c. of hydrochloric acid (1 : 1) are added, and the connecting tubes at once placed in position. After a few seconds the bottle is shaken gently, and then allowed to stand for one hour, after which the test paper is removed, dipped in molten paraffin, and compared with standard stains. The sample taken should be of such a size that the stain falls within the scale of standards given below. *Preparation of the Standard Stains.*—Saturate air-free distilled water with sulphur dioxide from a syphon; dilute this solution to a convenient strength with air-free distilled water, and determine the sulphur dioxide present by means of $N/20$ iodine solution. From this prepare five solutions containing 0·0001, 0·0002, 0·0003, 0·0004, 0·0005 grm. of sulphur dioxide, respectively, and 10 grms. of pure sucrose per 100 c.c. Air-free distilled water must be used and every precaution taken to prevent any oxidation of the sulphur dioxide during manipulation. Standard stains corresponding to 0·005, 0·010, 0·015, 0·020, 0·025 mgrm. of sulphur dioxide will be obtained when 5 c.c. of each of the above solutions are used in the apparatus. Since the test is also applicable to the determination of traces of hydrogen sulphide, it is probably advisable to express the stains in terms of sulphur. Attempts were made to differentiate between the sulphur in the two forms, but no satisfactory method was evolved. It was noticed that more intense standard stains were obtained when sulphur-free sugar was present than from plain sulphur dioxide solutions. Probably the sugar prevents displacement of sulphur dioxide by the hydrogen before reduction has occurred. When standard stains were prepared under these conditions with known amounts of hydrogen sulphide and sulphur dioxide, a comparison showed that one part of hydrogen sulphide was approximately equivalent colorimetrically to two parts of sulphur dioxide, thus indicating that complete reduction of the sulphur dioxide had occurred. It is necessary to carry out a " blank " test, and it is obvious that the quantity of sample required in the test will vary according to the amount of sulphur dioxide present. Thus when 1 part per million of sulphur dioxide is present, 10 grms. of the sugar will be found convenient, whereas when there are 20 parts per million only 1 grm. is necessary; hence a preliminary trial should be carried out to ensure that the stain may fall within the prescribed range of standards.

On the Alkalimetric Determination of Reducing Sugars, using Fehling's Solution. **M. D. Hadjieff.** *Zeitsch Unters. Lebensm.*, 1928, 55, 615-618. After washing the cuprous oxide well, it is dissolved in a measured volume of N/2 sulphuric acid and N/4 hydrogen peroxide, then the excess of acid titrated with N/2 sodium bicarbonate, adding three drops of methyl orange as indicator, the titration being continued until a yellowish-green tint is obtained (1 c.c. N/2 acid being equal to 0·015378 grm CuO).—Effect of Carbons and SO_2 combined on Juices, etc. **G. Mezzadroli and E. Vareton.** *Ind. Sacc. Italiana,* 1928, 21, 491-501, 545-554. Heavy sulphitation even at 85°C. followed by the addition of " Norit " does not cause inversion, as the carbon adsorbs the acidity. Such combined treatment is very advantageous, especially with dilute solutions (juices), the surface tension, for example, being diminished to a greater extent than alone. Further, the decolorization is said to be permanent, not being diminished when the juice is made alkaline. These results relate to laboratory experiments carried out with both cane and beet juices and molasses.—*pH* of Boiler Feed-Waters. **W. L. McCleery.** *Annual Report, Experiment Station, Hawaiian Sugar Planters' Association,* 1928. In some cases the *pH* of boiler feed-waters in Hawaiian factories was lower than 5·6 and in others higher than 10·0, these figures being the limits of the colour charts employed. Such extreme conditions of acidity and alkalinity are very undesirable. Determinations of *pH* and density should be made part of the daily routine of the factory chemist and a considerable amount of damage to boilers thus avoided.—Thermal Value of Bagasse. **W. L. McCleery.** *Ibid.* Samples representing fields rated as

producing bagasse good and poor in burning quality gave B.T.U. ranging from 8037 to 8363 per lb. of dry bagasse, or an overall difference of not over 4 per cent., which values are close to those found by Dr. NORRIS in 1912.[1]—NETT RETURNS PER TON OF SUCROSE IN THE SYRUP. **W. L. McCleery.** *Ibid.* A new schedule for allowances for polarizations above and below 96 passed into effect on the N.Y. market last year, and calculations of nett returns under this scheme have been made, as sugar shipped to the Western Refinery is sold on this basis. The following is a calculation of nett returns per ton of sucrose in the syrup with duty-paid sugar at 4 and 5 cents per lb. on the N.Y. market. These figures are based on 87 purity syrup and 37·5 purity molasses, bags and marketing expense, $10 per ton of raw sugar, commission, 2·5 cent., and the San Francisco basis of $5 under the N.Y. market. The new schedule which is based on c.i.f. prices on the N.Y. market makes no additional allowance above 98°, but the tariff differential constitutes a small allowance at polarizations above that degree. At both 4 and 5 cents nett returns increase up to 98°, above which they decrease. It seems advisable under this scheme to produce sugars not exceeding 97·5° polarization at the plantation, so that the sugar will arrive at the refinery as close to 98° as possible.

Polarization		Four-cent Sugar		Five-cent sugar
95	....	60·05	....	78·73
96	....	60·59	....	79·31
97	....	61·09	....	79·83
98	....	61·43	....	80·16
99	....	61·30	....	79·78

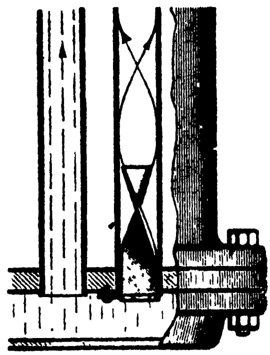
AUTOMATIC DENSITIMETER FOR EVAPORATORS, ETC. *Communicated by the manufacturers of the apparatus.* In the illustration is shown a densitimeter operating automatically and without the use of a specific gravity spindle. Juice or syrup to be measured passes into the apparatus through the lower opening on the right, fills a floating reservoir, and leaves through the upper opening on the left, the reservoir rising or falling according to the density of the liquid going through. This apparatus is patented, and is claimed to be highly accurate, being at the same time robust, and not easily put out of order. It can be supplied with a registering device, so as to provide a record of the course of evaporation, say in the last vessel of the multiple effect, or in a vacuum pan. It can be calibrated according to any scale, sp. gr., Brix,



Baumé, etc.—RAPID DETERMINATION OF WATER IN SUGAR, ETC. *Centr. Zuckerind.*, **1929, 37,** No. 8, 217. According to a Committee of the U.S.S.R., the late T. S. BONWETSCH patented a process[2] for the determination of water in sugars and like materials, accordingly to which a certain weight of the sample (after sub-division, if necessary) is mixed with a similar amount of powdered calcium carbide, after which the rise of temperature of the mixture is noted. By means of a table previously constructed with samples of increasing water content, the water percentage is then read.—A SENSITIVE NEW INDICATOR. **J. Zameron.** *Bull. assoc. chim. sucr. dist.*, **1928, 45,** No. 15. Litmus fails in many cases to show a sharp end-point, while phenolphthalein, rosolic acid, and methyl orange, are each sensitive to CO_2, phenolphthalein, e.g., indicating only 60-80 per cent. of the true alkalinity. Azuran, a very sensitive indicator, is therefore employed by the author for the accurate determination of the alkalinity of juices, syrups, massecuite, and molasses. Comparison of its results with those of p.p. show the latter to give figures lower than the truth. Using azuran-α, an alkalinity can be found in raw (beet) sugars, which according to both p.p. and litmus are neutral. Both azuran-α and azuran-β can be used for juices, syrups, and also for dark products, as molasses.—NEW TYPE OF CRUCIBLE FOR ASH DETERMINATIONS, ETC. ("WETA" WARE). **A. Karsten.** *Die deutsche*

[1] *I.S.J.*, 1912, 595, where a range from 8089 to 8344 B.T.U. was reported.
[2] Russian Patent, 8747, of October 31st, 1927; Class 421, 19.

Zuckerindustrie, 1929, **54**, No. 8, 194. Porcelain, it is pointed out, has disadvantages, chief amongst them being insufficient strength and insufficient resistance to heat. Recently a new material has been invented, composed of very finely divided carborundum with small amounts of silicates and metals as iron, cobalt and nickel. Crucibles made of it are found to be remarkably resistant to heat, are very strong, and, though not glazed, are unaffected by most mineral matter at high temperatures. They are grey, and a further advantage is that they heat up and cool down much more rapidly than does porcelain. They are known by the trade name of "Weta," and have been in satisfactory use in Holland and Germany.—QUARTZ PLATE STANDARDIZATION. **Fredr. Bates, C. A. Browne, and F. W. Zerban.** *Journal of the A.O.A.C.*, 1929, **12**, No. 1, 59-60. It is recommended: (1) That for purposes of research and of commercial analysis, in the case of refined sugars and other products of high purity, a normal weight of 26·026 grms. be employed in place of the present weight of 26 grms. for all saccharimeters whose 100° point has been established according to the HERZFELD-SCHONROCK factor. (2) That for purposes of research, in the case of sugar products of low purity where other errors exist, due to the volume of the lead precipitate or to other causes, a correction for all such errors be introduced at the same time as the proposed correction in the value of the normal weight.—DETERMINATION OF REDUCING SUGARS, POTENTIOMETRICALLY. **H. Tryller.** *Zeitsch. Spiritusind.*, 1929, 52, 27-28. One electrode is directly immersed in the boiling assay liquid (mixture of Fehling's solution and sugar solution), and the other is enclosed in a tube containing a similar solution free from copper, both being connected to a galvanometer. As the content of copper in the boiling mixture is reduced, the galvanometer deflection gradually approaches zero. It is stated that the end-point can be determined easily to within 0·1 c.c. of the sugar solution being added.—INCREASING THE EFFICIENCY OF EVAPORATORS, ETC. **Hans Wollenberg.** *Centr. Zuckerind.*, 1928, 36, No. 51, 1435. Liquids or gases (steam) passing through tubes are given a spiral motion, by means of a device shown in the illustration which is fixed at the end of the tube of the evaporator, heater, boiler, cooler, condenser, rectifying apparatus, or the like. By this simple means, the heat exchange is improved, and in the case of tubes of standard evaporators, incrustation is diminished.



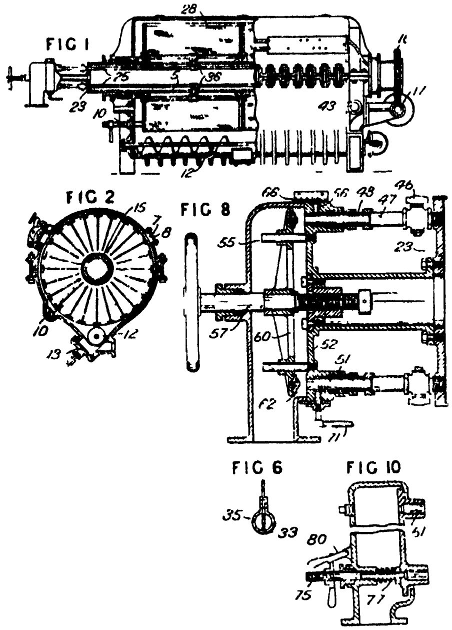
—UTILIZATION OF MOLASSES FOR THE PRODUCTION OF BUTYLIC ALCOHOL AND ACETONE. **G. Mezzadroli and G. Magno.** *Gior. Chim. Ind. Appl.*, 1928, 551. Very satisfactory rendements are claimed by the authors to be obtained by fermenting a 6 per cent. solution of cane molasses with special bacteria (better only with their spores) adding ammonium phosphate or peptone, or both, s yeast nutrients, and suspending in the liquid straw or paper, or other cellulosic material, and preventing the formation of acid by covering the liquid with a layer of oil, i.e., producing an anaerobic fermentation so far as possible. Yields of 27 to 31 grms. of a mixture of butyl alcohol and acetone were obtained per 100 grms. of sugar, calculated as invert. These products are of course worth very considerably more than rum or even rectified alcohol, and the cost of manufacture is hardly more. —CHARRING OF SUGAR BY SUPERHEATED STEAM. **P. Honig.** *Centr. Zuckerind.*, 1928, **36**, No. 46, 1270. In the Annual Report of the Java Sugar Experiment Station, the author mentions a case in which sugar in the centrifugals after being washed with water became gradually darkened and finally carbonized on being covered with superheated steam at 350°C. This happened within 6 min., yet it is known that sugar can be so treated with superheated steam as not to discolour at all even after 12 min. As the explanation of the occurrence, it is suggested that a small amount of oil has become decomposed in the vapour pipe at the high temperature to which it had been raised, which carbon mixed with some reduced particles of iron acted on the sugar as an oxygen carrier, thus decomposing it.

Review of Recent Patents.[1]

UNITED KINGDOM.

FILTER.* Henry A. Vallez, of Paris, France. 303,707. April 23rd, 1928.

The primary object of this invention is to design a filter with a hollow shaft, and having a plurality of radially arranged leaves radiating from the said shaft, each of which can be quickly removed or replaced after the shell is assembled and without removal or displacement of any of the remaining leaves. Another object is to design a rotating pressure filter having an individual discharge pipe for each leaf, and an individual sight glass in each pipe, so that the clarity of the filtrate is clearly visible to the eye, and the presence of a leaky leaf can be readily detected and located. A further object is to provide means for shutting off any one or more of the filter leaves without disturbing the operation of the remainder of the filter. Referring now to the drawings, filter-leaves 28, Fig. 1, are supported longitudinally on a hollow rotary shaft 15, each leaf being connected to a separate pipe 25 within the shaft for the discharge of filtrate. Each leaf comprises a corrugated plate enclosed in cloth and having one edge inserted in a slotted pipe 33, Fig. 6, which is in communication with the corresponding pipe 25 by means of a fitting 36 which covers an aperture 35. The casing of the filter is in two parts bolted together, the upper part having a longitudinal opening 7, Fig. 2, closed by a plate 8, through which any filter element can be detached and removed. The lower part is shaped to accommodate a spray pipe 10 which is used to aid in detaching the cakes formed on the elements. The solid material is directed to a central outlet 13 by a screw conveyer 12. The material under treatment is supplied to the casing under pressure through pipes 43. The shaft 15 and associated parts are rotated by worm gearing 16, 17. The pipes 25 are supported in a member 32 which closes the end of the shaft 15. Outside the casing each pipe 25 is provided with a cock 46, Fig. 8, and a sight glass 47 and is continued by a sleeve 48 which enters a cored passage 51 in a member 52 which forms one wall of a filtrate-receiving chamber 55. The ends of the passages 51 can be simultaneously closed by a rubber gasket 62 on a spider 60 which rotates with the member 52 but can be moved longitudinally by means of a screwed central spindle 57. The passages 51 have connexions 56 at right angles which are normally closed by a belt 66, but can be brought into communication with an air supply pipe 71 on the lower side. A modified form of filtrate-receiving chamber is shown in Fig. 10. An air or steam supply pipe 75 can be forced into engagement with the end of a passage 51 by means of a spring 77, but is held out of engagement during operation of the filter by means of a latch 80.



[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

RECOVERY OF SUGAR FROM BEET CARBONATATION SCUMS. **H. Claassen,** of Dormagen, Germany. 296,985. August 24th, 1928; convention date, September 10th, 1927. Sugar remaining in beet carbonatation scums is recovered by mashing and digesting the scum cake removed from the filters, with water at a fairly high temperature and separating the particles of sediment by filtering or otherwise, and returning the sugar-containing liquid as wash-liquid for the filter-presses instead of the usual pure water, or introducing it at another stage of the factory process.—COLOUR ESTIMATING APPARATUS. **O. Rosenheim, E. H. J. Schuster, and Tintometer, Ltd.,** of The Friary, Salisbury. 299,194. Apparatus of the Tintometer type for the estimation of the colour value of any given substance by matching the colour with the tint or combination of tints exhibited by light transmitted through a superposed assemblage of colour screens is provided with means for facilitating the selection of the screens and indicating the selection upon a scale.—FILTERING LIQUIDS. **Soc. anon. Procédés R. Audubert,** of Paris. 299,488. September 27th, 1928; convention date, October 27th, 1927. The invention consists in a process of filtration utilizing electrical adsorption phenomena, filtration taking place under low pressure difference. Upward filtration through fibrous material impregnated with electrolytic re-agents, is described.—PRODUCTION OF PULP FROM BAGASSE. **H. Kumagawa,** of Hongoku, Tokio, Japan. 299,740. June 30th, 1927. Plant raw material containing pith fibre such as cane sugar bagasses or kaoliang (giant millet or guinea corn) straw, is beaten in a hollander under a constant flow of hot or cold water to remove the sugar and other water-soluble substances and to separate the long thin and short pithy fibres. The long fibres are suspended in the water while the short pithy fibres float on the surface, the separated fibres being collected in suitable devices. The long fibres only, or together with a suitable proportion of short fibres, are used for pulp.—SACCHARIFICATION OF CELLULOSE (ALCOHOL PRODUCTION). **International Sugar and Alcohol Co., Ltd.,** of London. 299,844. October 24th, 1928; convention date, November 2nd, 1927. In a diffusion process for saccharifying cellulose-containing material with hydrochloric acid, the material is pre-mashed in a mixer with a part of the total acid used and then transferred to the diffuser. The proportion of acid used in the mixer is such that the heat developed in the subsequent treatment in the diffuser produces a temperature of 25-30°C. The liquid used for pre-mashing is preferably an acid solution of partially hydrolized cellulose from a previous diffusion. FILTERING LIQUIDS. **V. R. Heftler,** of Detroit, Mich., U.S.A. 303,153. December 17th, 1928; convention date, December 30th, 1927. This patent relates to a method of assembling a stack of laminae upon a central support to form a filter element, the laminae being of two different forms arranged alternatively.—HARVESTING BEET. **H. G. Morton and F. A. Standen,** of St. Ives, Hunts. 303,577. October 11th, 1927. Beets (or like root crops) are placed separately in receivers carried by chains passing round chain wheels on shafts, each receiver being formed with an inclined bottom provided with pins upon which the root is impaled. The back of each receiver is cut away to take a presser foot during the topping operation and a roller for ejecting topped beets respectively. The linked members are mounted on spring pressed rods riding in bars carried by arched members. While under the presser foot each beet has its base cut off by a rotary cutter and then its crown cut off by a second rotary cutter, the bases being deflected by a member clear of the machine, and the crowns by a member into a sack to be used as cattle food. The root is then engaged by the roller and pushed off the spikes, falling at the turn of the conveyor on to revolving lantern rollers by which soil is removed from the roots.—VISCOMETERS. **I. G. Farbenindustrie A.-G.,** of Frankfort-on-Main, Germany. 303,853. December 28th, 1928; convention date, January 11th. Relates to the type in which the resistance to a body rotating in a liquid is measured, and consists in mounting the body on an overhung spindle by means of a needle point and cup bearing, the lateral pull of a thread by which the body is rotated being taken up by the needle point.—MANURES. **J. T. Johnson** (communicated by the **I. G. Farbenindustrie A.-G.,** of Frankfort-on-Main, Germany. 303,916. September 12th, 1927. A fertilizer is made by mixing together potassium nitrate and sodium nitrate, the amount of sodium nitrate being preferably between 20 per cent. and 50 per cent. of the whole and not more than 60 per cent.

UNITED STATES.

CONVEYOR FOR CANE MILLS. **William A. Ramsay**, of Honolulu, T.H., U.S.A. 1,690,877. November 6th, 1928.

The structure comprises a series of large conveying rollers arranged in parallelism and extending between adjacent crushing mills, one of said rollers being driven by connexions to a roll of the delivery mill, and small friction rollers being positioned between and contacting two adjacent conveyor rollers, whereby to cause all of the conveyor rollers, throughout the train connecting said crusher mills, to rotate in the same direction, to transport bagasse from one mill to the other. Referring to the drawings, 1 and 2 are rolls of a mill from which bagasse is to be delivered to the rolls 3 and 4 of the adjacent mill. Suitably supported to extend between said mills is a conveyor trough formed by upright metallic side walls 5, and a front end wall 6. The front wall 6 of the trough is equipped with a feed inlet provided with known devices facilitating the delivery of the bagasse from the front mill to the trough.[1] Secured to each side of and at the bottom of each of the walls 5, are a plurality of roller bearings 8, mounted on trunnions 9 extending through said wall, said bearings 8 being

Fig 1

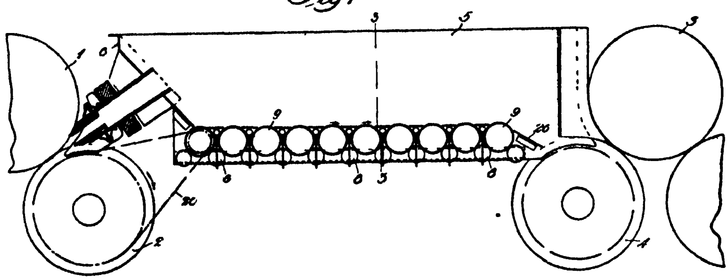


Fig 2

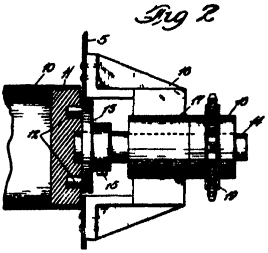
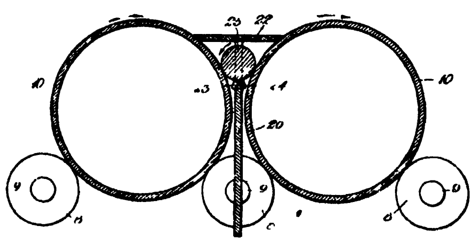


Fig 4



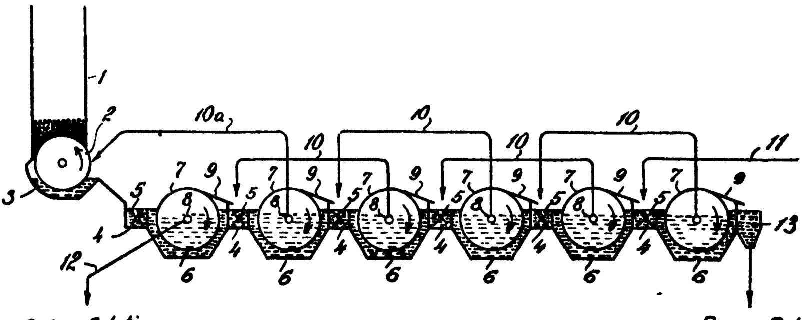
so positioned as to properly support tubular conveying rollers 10, so that each end of each of said rollers rests upon two of the bearings. The rollers 10 are in the form of cylinders (Fig. 2), the ends being closed by a plug 11, into which extend coupling members 12, secured to a hub portion 13, surrounding the roller shaft 14, and secured to said shaft by a pin 15. A supporting bracket 16 is riveted or bolted to the metallic side 5, and said bracket is provided with a bearing portion 17 adapted to receive the shaft 14. The structure just described may be applied only to the first roller at the left (Fig. 1), or to any other roller in the train, if found more desirable, the other rollers 10 being journalled in simple anti-friction bearings in the side walls 5, 5. Or the bracket 16 may be extended longitudinally along each side of the walls 5 to provide bearings for each of the end shafts of each roller 10. On the outer end of the shaft 14 secured to the roller 10 adjacent the crusher rolls 1 and 2, is non-rotatively secured a hub 18 of a sprocket wheel 19, adapted to be engaged by a sprocket chain 20 operatively connected to the crusher roller 2. Instead of the sprocket and chain connexions described, the hub 18 may be replaced by a pulley, and a drive belt operatively extended from the crusher roll 2 to said pulley. In some

[1] U.S.P., 1,191,826.

cases it may be desirable to drive the first roller 10 by means of an independently mounted electric motor operatively connected to the shaft 14 thereof. It is to be noted that the conveyor rollers 10 are not in contact each to each, but that both ends of each roller rest upon two of the bearings 8. A partition member 20 is secured at each end by passing through slots cut in the end of the trunnion pins 9, each partition extending upwardly between adjacent rollers 10, and provided with a cut away portion at each end to clear the bearings 8 as illustrated in Fig. 4. The partitions each terminate in a T-shaped platform 22, the lower surface of the edge of each branch of the platform being formed on an arc of a circle and shaped to the configuration of the outer surface of the closely adjacent rollers 10. Below the platform 22 the partitions are each slotted as shown, the lower flanges 23 and 24, of the walls defining the slots, being turned in diametrically opposite directions, and providing a bed or trough to receive one or more circular bars of cold rolled steel 25, hereinafter called friction rollers. The construction and position of the several instrumentalities described is such that, with the friction rollers 25 in position, as shown in Fig. 4, each friction roller will contact both of the adjacent conveyor rollers 10, and, at the same time, rest lightly upon the flanges 23 and 24, a platform 22 covering each of bars 25. The rear end of the trough formed by the walls 5, 5, is located closely adjacent the receiving crusher rolls 3 and 4, the lower portion of the said walls being shaped to co-operate with an inclined platform 26, located below and adjacent the last of the rollers 10, to deliver the bagasse to said rolls 3 and 4.

PREPARING CANE FOR THE RECOVERY OF SUGAR AND PULP FOR PAPER MAKING. **Eugenio A. Vazquez**, of Habana, Cuba (assignor to **Vazcane Process, Inc.**). 1,688,905. October 23rd, 1928.

This apparatus consists, briefly, in means for separating the cane by grinding or abrading it into individual fibres or aggregates of relatively few fibres so small as to be unsuitable for any of the prior methods of sugar recovery. In combination with this is used a solvent bath in which the comminuted material is dispersed and agitated until the solvent is thoroughly worked into the fibres; the solvent—or more accurately, the sugar solution—is then separated from the comminuted cane and the latter redispersed in a second bath. In this bath the material is again agitated in the same manner as in the first, after which it is again separated. These dispersing, agitating and separating means are repeated as often as is necessary to complete the separation of sugar juice from the cane. Referring to the drawing, at 1 is a hopper



adapted to hold a supply of cane (or other material to be treated). At the bottom is a grindstone 2 running in a receptacle 3 containing a bath of water. Consequently the operation of the grindstone will cause the solution to be carried to the cane and cause the grinding to take place in a substantial amount of liquid. The pulp passes directly to the mixing box 4, or may first be screened. An agitator blade 5 in the mixer maintains the pulp in suspension. The overflow from the mixing box 4 passes into a separater 6, which in the present case is shown as a pulp thickener, well known in the paper-making art. In this form of separator a cylindrical screen 7 revolves partially submerged in the pulp so that the water, or

liquid, passes through the screen and is drawn off through the opening 8, while the solid portion of the pulp is deposited on the screen, carried out of the bath and scraped by the doctors 9 into a second mixing box 4. The pipe 10 discharges the weak sugar solution from a subsequent separator 6 into this mixing box. Any number of separators and mixing boxes may be used. Into the last mixing box, fresh water is directed from the pipe 11, and from the first separator the strong sugar solution is discharged through the pipe 12 to the sugar-boiling house. The liquid from the second separator is conducted through the pipe 10^a to the grinder 2, where it is sprayed uniformly over the surface of the grindstone. The pulp from the last separator is discharged into the conduit 13, from whence it is taken directly to a paper making plant or to a machine where it is made into pulp lap for shipment. The counter-current washing of the finely divided vegetable material is enhanced by the successive separations of the pulp from the liquid. This repeated separation and redistribution of the water through and into the fibres, thereby dissolves all of the sugar, while the mechanical treatment to which the material is thus subjected produces a further separation and " brushing out " of the fibres, which reduces the amount of beating required in the subsequent treatment of the paper pulp.

REVIVIFICATION OF BONEBLACK (ANIMAL CHARCOAL OR CHAR). **William W. Kemp.** 1,692,745. November 20th, 1929.

With a comparatively simple and inexpensive apparatus, and employing an improved method, it is possible to very completely treat the char, so as to bring it to the proper condition, without the destructive effects of exterior firing, and without the necessity of the more or less expensive and complicated apparatus now in use. It is proposed to internally fire the retort and subject the char to be revivified to a temperature sufficiently high to free the gaseous constituents or impurities and leave the cleansed and revivified char in the retort. This internal firing is accomplished in the absence of sufficient air to support combustion, either of the volatile products, or the material under treatment, while, at the same time, the heat generated is sufficiently high to accomplish the result aimed at, the heat being generated by the flame of a self-sustaining mixture introduced into the retort. Referring to the drawings, 10 indicates the revivifying chamber, which may be of any approved form, but is preferably, as shown, in the form of a cylinder which may be rotated in any suitable manner, and is provided with a suitable filling opening having the door or closure 11. The receptacle 10 may be lined, if desired, with refractory material, as conventionally illustrated, and may be mounted for rotation as may be desired, and any convenient means for driving it may be provided. At one end of the receptacle 10 is provided a stuffing box 12 through which passes an inlet pipe 13 for the fuel, preferably gaseous. At the opposite end of the container 10 is provided a similar stuffing box 14 through which delivers the outlet pipe 15 for the volatile products driven off from the char 16, conventionally illustrated, as well as the gases of combustion from the internal firing flame. Preferably the delivery pipe 15 will have the upwardly turned neck 17 within the container 10 to receive the gases rising from the material 16 to the upper part of the chamber. The exclusion of air from the container 10 so as to prevent actual combustion of the material, or liberated gases, and maintain a true distilling action is insured by providing a closed container, such as the container 10, and by maintaining within that container a pressure from the inlet pipe 13 through which the self sustaining mixture passes sufficiently to prevent the entrance of air under atmospheric pressure through any openings or joints in the container. Revivification of the char 16, however, is accomplished by internal firing, without any danger of burning of the volatile products, by delivering through the pipe 13 a fuel,

Fig. 1

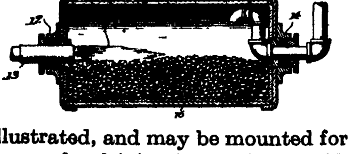
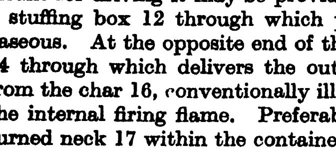


Fig. 2



which is preferably gaseous, and of a self-sustaining character, so that it will burn in the air-tight container, the jet of burning fuel being conventionally illustrated at 18 in Fig. 2. The fuel delivered through the pipe 13 is a mixture of gas and air so regulated as to proportion that it will burn in a confined space, there being just sufficient air to support combustion of the fuel, but insufficient to cause ignition and burning of the char 16 or any of the volatile products of the material, and the gaseous constituents, as they are liberated, accumulate in the container 10 and are drawn off through the neck 17 and the delivery pipe 15. The air and gas of the gaseous mixture supplied to the burner which has been herein referred to as a "self-sustaining mixture," because it does not contain oxygen in excess of that required to effect combustion of the mixture and not sufficient to effect combustion of the char or gases evolved therefrom during the revivification, are thoroughly premixed outside the retort. For this purpose, any suitable means may be employed. An apparatus which is adapted for the preparation of such a "self-sustaining mixture" is illustrated and described in patent to KEMP and VAN HORN.[1] The elements of the gaseous mixture are thoroughly premixed before being admitted to the burner or pipe leading thereto and thereby any stratification of the gas and air portions which might introduce into the container sufficient free oxygen to effect any combustion of the char being treated or of gases evolved therefrom is avoided. In operation, the cylinder or retort 10 will receive its load of char which is to be revivified, the jet 18 will be ignited, the door 11 closed, and the retort 10 will then be revolved to agitate the material 16 and bring fresh material into the zone of action of the flame.

MANUFACTURE OF NEUTRAL SODIUM PHOSPHATE. **Charles F. Booth** and **Arthur B. Gerber,** of Anniston Ala., U.S.A. 1,700,972; 1,700.973. February 5th, 1929. Claim is made for the process for the production of tri-sodium phosphate containing no free alkali which consists in providing a disodium phosphate solution substantially free of sodium carbonate, and adding caustic soda to the solution until the resultant solution has a relation of the phenolphthalein titration to the methyl orange titration of 0·432 to 0·451.—ARTIFICIAL FERTILIZER. **Heinrich Heimann (I.G. Farbenindustrie A.G.),** of Frankfort, Germany. 1,698,793. January 15th, 1929. A process for producing a compound, non-deliquescent fertilizer, consists in mixing together inorganic fertilizing salts and a hot concentrated aqueous solution of ammonium nitrate and recovering the mixed salt in its solid phase by evaporating water by means of heat contained in the mixture.—PRODUCTION OF GLYCERIN FROM MOLASSES, ETC. **Karl Lüdecke** and **Nelly Lüdecke,** of Berlin-Dahlem, Germany. 1,698,800. January 15th, 1929. A process for the production of glycerin consists in fermenting sugar with yeast in an alkaline solution and after partial fermentation separating the yeast from the mash then distilling off the fermentation products boiling below 100°C. from the fermented mash and adding a fresh quantity of sugar and the recovered yeast to the remaining mash and re-fermenting the same, repeating this process until the glycerin content of the fermented mash has reached the desired concentration.—PURIFYING PROCESS. **Arthur B. Ray** (assignor to the **Carbide and Carbon Chemicals Co.,** of New York). 1,699,449. January 15th, 1929. Process of purifying solutions containing dissolved salts and organic colouring matter comprises treating the solution with a quantity of water-insoluble alkali-earth or metal phosphate adjusted for the precipitation of the principal portion of said salts, and with a quantity of absorptive carbon adjusted for the removal of substantially all of said colouring matter.—MIXED FERTILIZERS. **Ernst Schwarz** (assignor to the **I. F. Farbenindustrie A.G.,** of Frankfort, Germany). 1,699,254. January 15th, 1929. A mixed fertilizer comprises urea, dicalcium phosphate, and a fertilizing potassium salt.—CENTRIFUGAL SEPARATOR. **William C. Laughlin** (assignor to the **Laughlin Filter Corporation,** of New York). 1,699,471. January 15th, 1929. A rotary separator of the bowl type comprises a frusto-conical casing having a discharge opening for fluid and a second discharge opening for solids, and a rotor within said casing having a sloping wall substantially parallel with and spaced from the inner wall of said casing, said inner rotor having perforated spiral flanges dividing the space between said walls into compartments.

[1] U.S.P., 1,420,658.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending March 31st.		Three Months ending March 31st	
*Unrefined Sugars.	1928. Tons.	1929. Tons.	1928. Tons.	1929. Tons.
Poland	....	517	....	26,812
Germany	....	2,040	....	2,651
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	3,416	....	4,929
Java	1,748	14,779	1,748	66,267
Philippine Islands	....	....	....	....
Cuba	25,904	18,978	115,790	78,731
Dutch Guiana	....	....	....	....
Hayti and San Domingo	24,361	24,480	33,180	28,015
Mexico	....	....	....	....
Peru	10,619	10,482	34,532	47,100
Brazil	2,061	729	9,188	9,086
Union of South Africa	494	557	11,933	19,831
Mauritius	11,092	43,476	74,405	130,933
Australia	15,255	12,155	57,326	94,732
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	4,411	3,667	21,422	7,676
Other Countries	5,639	6,957	17,002	16,502
Total Raw Sugars	**101,584**	**142,233**	**376,528**	**533,263**
*Refined Sugars.				
Poland	1,019	....	2,035	....
Germany	85	....	571	28
Netherlands	12,204	4,107	32,601	5,940
Belgium	444	148	1,716	396
France	....	....	....	....
Czecho-Slovakia	14,011	268	34,526	3,246
Java	....	....	....	....
United States of America	2,330	960	3,859	2,234
Canada	249	2	251	6
Other Countries	1,956	3	2,263	11
Total Refined Sugars	**32,298**	**5,488**	**77,823**	**11,861**
Molasses	20,315	17,139	54,429	69,537
Total Imports	**154,197**	**164,860**	**508,780**	**614,661**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	124	164	299	332
Netherlands	45	24	121	69
Irish Free State	7,234	2,725	13,074	8,920
Channel Islands	152	148	483	280
Canada	....	....	....	....
Other Countries	731	8,110	3,227	11,761
	8,286	11,170	17,204	21,363
Foreign & Colonial Sugars.				
Refined and Candy	60	106	202	386
Unrefined	80	27	179	136
Various Mixed in Bond	....	....	....	....
Molasses	1,096	975	2,228	2,566
Total Exports	**9,522**	**12,278**	**19,813**	**24,451**

*The corrected quantities and values of the Imports of Sugar are here given for 1926 and 1927.

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to Mar. 23rd	876,680	..	767,581
Deliveries „ „	798,278	..	632,641
Meltings by Refiners „ „	661,804	..	606,100
Exports of Refined „ „	22,000	..	19,875
Importers' Stocks, Mar. 23rd	176,633	..	243,480
Total Stocks, Feb. 23rd	377,831	..	315,067
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT FEBRUARY 28TH.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	549,401	..	295,140	..	712,191
Stocks	702,733	..	671,487	..	947,380
	1,252,134		966,627	..	1,659,571
Local Consumption..	18,000	..	11,541	..	15,643
Receipts at Ports to February 28th ..	1,270,134	..	978,168	..	1,675,214

Habana, February 28th, 1929.

J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR THREE MONTHS ENDING MARCH 31ST, 1927, 1928, AND 1929.

IMPORTS.	1927. Tons.		1928. Tons.		1929 Tons.
Refined......	124,278	..	77,823	..	11,861
Raw	250,228		376,528	..	533,263
Molasses .	24,331		54,429	..	69,537
	398,837		508,780		614,661

EXPORTS (Foreign).	1927. Tons		1928 Tons.		1929. Tons.
Refined...... ..	584	..	202	..	386
Raw	277	..	179	..	136
Molasses	104	..	2,228	..	2,566
	965		2,609		3,088

HOME CONSUMPTION OF IMPORTED SUGAR.

	1927. Tons.		1928. Tons.		1929. Tons.
Refined	139,352	..	81,556	..	11,006
*Refined (in Bond) in the United Kingdom	164,631	..	233,037	..	201
†Raw	39,815	..	37,945	..	452,527
Total of Sugar	343,798		352,538		463,734
Molasses	1,497	..	1,151	..	2,507
Molasses, manufactured (in Bond) in United Kingdom ..	21,057	..	22,414	..	1
	366,352		376,103		466,242

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT MARCH 31ST.

	1927. Tons.		1928. Tons.		1929. Tons.
Manufactured from Home Grown Beet	19,450	..	25,450	..	37,450
Refined in Bond	69,800	..	87,450	..	3,300
Foreign Refined	88,850	..	19,500	..	13,250
„ Unrefined	170,200	..	179,150	..	254,850
	348,300		311,550		308,850

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries, to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 136,837 tons entered for refining in refineries in the month ended 31st March, 1929, and 416,929 tons in the three months ended 31st March, 1929.

United Kingdom Monthly Sugar Report.

Our last report was dated March 11th.

The general condition has been depressed all over the world, and the easier tendency has again manifested itself, both for Raw and Refined.

The White Terminal Market has been more active and prices have declined with the exception of March where there was a small "bear" squeeze. The price at the end of the month was 12s. 9d., having been done at one moment up to 13s. 10½d. Altogether, about 14,000 tons were tendered. These tenders included the total London stock and about 4000 tons was imported to impliment short sales. May was sold down to 11s. 0¾d., August to 11s. 7½d., December was done at 12s., January at 12s. 1½d. and March at 12s. 3d.

The Raw Terminal Market has again shown heavier registrations than the White sugar. The prices over the month have shown a fall of about 6d. per cwt. May sold down to 8s. 2¼d., August to 8s. 9d. and December to 9s. 2¼d., whilst March sold at 9s. 6d. The latest prices are :—

	MAY		AUGUST		DECEMBER		MARCH, 1930
White........	11s. 1½d.	..	11s. 8¼d.	..	12s. 0d.	..	12s. 3¾d.
Raw	8s. 3¾d.	..	8s. 10½d.	..	9s. 3¾d.	..	9s. 7½d.

Dealings in actual sugar have been very slow, in view of the approaching Budget, as traders all over the country are running their stocks down to the lowest possible point. Refiners have made no change and their latest prices are No. 1 Cubes 26s. 3d., London Granulated 23s. 4½d. Prices for Home Grown are slightly easier and 22s. 6d. to 22s. 1½d. less the usual 4½d. rebate are the prices asked to-day according to the factory.

Continental Granulated has been slightly easier. Dutch Granulated is maintained at 11s. 6d., whilst Czecho Granulated for re-opening can be obtained for 11s. Polish and German Crystals sold at 10s. 10½d. f.o.b.

Raws have been quiet and the price has steadily fallen to 9s. c.i.f. at which price the refiners are buyers to-day, with sellers at 9s. 1½d.

The American Market has been easier. Raws sold down to 1⅞ cents and one or two isolated lots sold at a fraction lower price than this. To-day there are still sellers at the former figure. The Futures Market has fallen from six to fifteen points.

There is no news with regard to Europe except that F. O. Licht suggests that there may may be a slight increase in the sowings.

The Cuban production to the end of March is 3,850,000 tons against 3,250,000 tons last year, whilst the exports are given as 1,400,000 against 900,000 tons in 1928. The stock in the Island is about 100,000 tons larger than a year ago.

21, Mincing Lane,
London, E.C.3.
9th April, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 365. MAY, 1929. VOL. XXXI.

Notes and Comments.

The Outlook.

Sugar markets continue to reveal a depressing atmosphere, and quotations to stand at nearly the lowest on record. The Cuban crop is proving about as big as the maximum estimates put forward, though WILLETT at the time of writing this has not altered his estimate of some five months ago of 4,900,000 tons. Actually a total around 5,200,000 tons looks much more likely. Java is in a stronger position than a year ago, and, leaving out of question prospective exports of new crop sugars later on, is about to dispose of a large parcel of old crop—said to be anything up to 200,000 tons—that has been in the hands of exporters since last November destined to be sold west of Suez. Some of this is already sold to British refiners at 9s. 0¾d. c.i.f., basis 96°. It is too early to say whether Cuba will be able to maintain her last year's export quota to Europe in the face of increased Java competition; but Cuba is not unmindful of the advantages of looking for other destinations, and is believed to be exploring the possibilities of using the Far Eastern market for her surplus sugars; this policy is urged with some detail in an article on another page of this issue by a Cuban writer who seems to have studied the matter at considerable length. Incidentally, he points out that the world markets have no use for surplus raw sugars unless there is a refinery available; Cuba, he avers, should be prepared to refine her sugar on the island and then would have a direct consumption product ready to sell to any consumer—in the East or elsewhere. This year the East is faced with a still bigger Formosa crop, now put at about 762,000 tons, or 60,000 higher than the estimates; so much depends on the Chinese market being stimulated to take larger amounts. LICHT's first estimate of the beet areas in Europe published last month was compiled with some difficulty, and Russia is the dark horse this year. The total area arrived at for Europe without Russia is a trifle less than last year, but is probably subject to a good deal of amendation as the season advances.

As we go to press, there comes the news from America that the new Tariff Bill, long awaited, has made its appearance before Congress, being presented by the Ways and Means Committee on May 7th. For some weeks

past it has been believed that the Committee would recommend the raising of the duty on sugar from 2·20 to 3 cents per lb. as regards foreign sugar, and from 1·76 to 2·40 cents for Cuban sugar. Anticipations have proved correct, for these are the proposals embodied in the Bill. These alterations if they go through will of course stimulate further production of sugar within U.S. territory; but there is as yet no certain indication that Congress will pass them; nor if it does, what the date of coming into force of the new duties will be. It might be in two or three months' time or as late as November. The earlier date would obviously create a strong buying movement to stock the American market before the new tariff came into force. The later date, on the other hand, would upset the market much less. In the long run the new rates of duty can hardly help Cuba to dispose of her huge crops. One notes that no limitation is to be placed on the present free importation of sugar from the Philippines, which is not surprising when it is considered that Mr. STIMSON, Mr. HOOVER's Secretary of State, is opposed to any restrictions in this direction. The result will be the further expansion of the Philippine crop, doubtless at Cuba's expense.

The 1929 Budget.

On April 15th Mr. WINSTON CHURCHILL unfolded his fifth and possibly last Budget before the House of Commons. In view of the imminence of the General Elections which are fixed to take place on May 30th, there was considerable speculation as to how he would deal with the surplus he had available. He elected to repeal the whole import duty on tea of 4d. per lb., and to give slight alleviations to a number of inland revenue taxes. Contrary to the hopes engendered in many quarters there was no change in the incidence of the sugar duties, so that the alterations effected in 1928 remain in force. And the income tax was left untouched.

Disappointment is naturally felt in circles interested in Empire development that no further assistance is for the moment offered British overseas sugar growers. But to judge from the Government's policy with regard to Mauritius, it would appear that they prefer the line of offering financial assistance in the shape of a loan to tide over the depression caused by the unremunerative price of sugar, rather than make further Budget concessions on the eve of an election which may conceivably remove them from office and substitute an entirely different party in the seat of Government. Meantime, the home refiners have the most to show for the 1928 concessions. Mr. CHURCHILL claimed that the sugar remission of last year had cost one million pounds more than he had expected, due to the very rapid shrinkage in imports of foreign refined sugar. But the British refining industry has since then increased its share of the home market from 50 per cent. in 1927 to 70 per cent. at the present time. During the seven months or so the 1928 Budget duties were in force last year, the imports of raw sugar into this country were increased by over half a million tons as compared with 1927. The refiners' view of the present Empire position, as voiced by Sir LEONARD LYLE in a letter to the press, is that a regular market is now assured in the United Kingdom for raw sugar of Empire origin and that an increased preference would have the refiners' support always providing it is designed to encourage the production of raw sugar polarizing 99 and under. But obviously they view with disfavour any higher polarization; and for the time being they carry the day.

Notes and Comments.

The General Election.

By the time these lines appear the election fever will be at its height, and the two Opposition parties—the Liberals and the Labour Party—will be trying to persuade the country that the Conservatives have been in office long enough and that a change of Government is desirable. The Liberals who are much the smallest party in the expiring Parliament—less than fifty all told—have latterly been galvanized into activity once more by Mr. LLOYD GEORGE and are now expected to give a better account of themselves at the polls than looked likely a year ago. But at best they can hardly expect to win more than 100 or 120 seats out of a house of 615 members; so their intrusion of a candidate in nearly every constituency will in the majority of cases merely spoil the straightness of the fight between the Conservative and the Labour candidates, favouring the chances of the one in some places and of the other in others, but in either case, presumably, leaving the Liberal at the bottom of the poll. If neither of the two major parties has a clear majority over the other two, then the hundred odd Liberals elected doubtless expect to use their increased weight to trim the parliamentary boat to their own advantage.

As far as sugar is concerned, the return once more of the Conservatives would be a guarantee that the present Imperial preferential policy will be continued and possibly further extended. As for the Labour party, its saner spirits recognise the value of an alliance with the other parts of the Empire, but they have their prospective Chancellor of the Exchequer in the person of Mr. Philip Snowden who is an implacable opponent of all deviations from doctrinaire free trade and may be relied on to press for his own point of view. Whether he would get his way would probably depend on the strength of the parties in opposition. The Liberals remain wedded to Free Trade, which for all practical purposes is merely " free imports," so in the extremely unlikely event of their being able to accept office, it may be assumed they would try and frame a Budget which would dispense with all preferences.

However these speculations are merely the outcome of party declarations of policy which all depend on getting a clear majority over all opponents in the next Parliament. On the face of it, the only party that seems able, if at all, to get such a clear majority is the Conservative one. But the unknown factor this time is the large accession of women's votes, running into millions. It will be extremely interesting to see whether these votes go according to forecast or on the contrary have an utterly unforeseen effect on the polling results.

Conditions in the British West Indies.

The low price of sugar that has ruled for several years has tended to accentuate the difficulties under which the industry has carried on in the British West Indies, and these are receiving a fair amount of official attention. In a review of Colonial progress given in the House of Commons the other day by Mr. AMERY (Secretary of State for the Colonies), he remarked that sugar was the only one of the great Colonial primary products that was in a difficult plight. Thanks to the preference initiated after the war and stabilized four years ago there had been a considerable expansion of sugar growing in the Empire. It was being menaced by the price war waged between the American producers in Cuba and the producers in Java. Mauritius, Barbados, British Guiana and some of the smaller West Indies were all feeling the stress of that war and were involved in considerable difficulties.

The British Trade Commissioner in the West Indies in his last report of the economic state of affairs in that quarter also refers to the exceptional position of sugar. Financial conditions in the British West Indies during the past two years have been satisfactory, he points out, large surpluses having been declared in Jamaica and Trinidad and favourable balances elsewhere, the only important exception being British Guiana where a series of deficits has been recorded. Unfortunately this favourable financial position is not reflected by any great increase in business. On the contrary there is a sense of depression with a consequent reluctance to spend, which may be ascribed to a widespread anxiety as to the future, principally because of the decline in prices of the principal staple products. The sugar industry in particular is passing through a critical period and though falling prices have been somewhat offset by exceptionally large crops the general state of the industry cannot have other than a depressing effect upon trade generally in those colonies, notably Barbados and British Guiana. Trinidad not being dependent on sugar to the same overwhelming extent is in a rather more favourable position than her neighbours. Elsewhere in this number in some extracts we give from this Report will be found a table showing the proportion of the chief staple crops which the several West Indian islands cultivate.

British Guiana's Plight.

In British Guiana conditions would appear to be worse than in any other part of the British West Indies. During recent years the increasse in agricultural production, which had been well marked from 1900 to 1918. ceased, and a notable decrease ensued from a total area under cultivation of, in round figures, 194,000 acres in 1918 to one of 143,000 acres in 1926. The great decrease has been due largely to unpropitious seasons, accentuated by floodings of cultivated lands. The floods in the past were not so much caused by exceptionally heavy rainfalls as by the highly unsatisfactory conditions regarding drainage which had arisen in many parts of the front lands, but which are now to a great extent ameliorated by the installation of pumping stations. Further reasons for the decrease are the paucity of available efficient labour, due largely to the cessation of East Indian immigration. to the formidable visitation of influenza in December, 1918, and January, 1919, which materially affected men from 20 to 40 years of age in the agricultural districts, and reduced the population of the Colony by over 6000 persons, and also to the migration of many of the more energetic and venturesome of the native agriculturists and peasant proprietors from cultivating the soil to searching for diamonds in the interior of the Colony.

League of Nations and the Sugar Problem.

If any optimistic hopes were entertained of the outcome of the deliberations at Geneva early in April on the part of the Economic Committee of the League of Nations in respect to the sugar question, they were necessarily doomed to disappointment Thanks to the co-operation of the sugar experts called in consultation, the Committee got a good general insight into the position of the world sugar industry. But it soon became clear that the only practicable means of alleviating the situation was by adopting two definite measures which comprised, firstly, the stabilization of production during a period of three or four years, and, secondly, the making of efforts to increase the consumption of sugar. The League cannot, however, initiate measures of this category because these depend for their successful application on a definite agreement between international producers. The League, it was

emphasized, is an association of States and the only measures it can take are Government measures. Hence till the Governments of the sugar countries concerned are prepared to take concerted action, the League can merely hold a watching brief and try and influence world opinion. The only line which lies open to it through its Government components seems to be in the direction of curtailing that barrier of artificial measures of various kinds—bounties and prohibitive import duties—for which States are mainly responsible, and which hamper the natural increase in sugar consumption. Possibly something of this sort may eventually be attempted ; but it is a thorny subject and it would not be easy to get the respective States to agree to a policy that, it would be alleged, was subversive to the interests of the home sugar industry of the State concerned. The Economic Committee proposes to take till June to prepare its Report, and meantime is consulting with experts of the beet sugar industry in respect to that branch of sugar production. In June we should know whether the League proposes to press with its advice, even though it sees no method by which it can take action.

Java Crop Prospects.

According to Messrs Willett & Gray, writing at mid-April, the exports from Java during the month of March were 155,000 tons. This brings the total exports of the crop, harvesting of which commenced in April-May, 1928, to end of March, 1929 to 2,567,030 tons. The total crop from which the above exports were made out-turned 2,939,164 tons, and as the new crop will not commence until the end of April or early May, 1929, there will be practically no carry-over although the crop just mentioned was 570,000 tons larger than the previous one. Consumption in Java is increasing and reaches fully 330,000 tons a year.

The same firm's Java correspondents reported under date of March 5th, 1929, in regard to the Java crop, harvesting of which commenced at the end of April, 1929 : " It is too early to say that the out-turn may eventually not be 3½ million tons, but so far we doubt that such a total will be reached. The increase last season has been due to most favourable weather conditions, so that the old cane varieties were giving results previously not thought possible ; it is therefore likely that POJ 2878 also profited by the weather conditions and that the results obtained from this new variety have also been extraordinary. Although the monsoon has been very irregular, so far growing conditions for the next crop seem to have been favourable although it remains to be seen whether to an extent equal to last year."

The Glebe Refinery, Greenock.

The well known Glebe Sugar Refinery, at Greenock, which has been for so long in the hands of the KERR family, has lately been disposed of to Messrs. Tate & Lyle, and thereby a merging of the Greenock sugar interests has been completed, for some months ago Tate & Lyle acquired a controlling interest in Messrs. John Walker & Co.'s refinery. A new company has been formed in connexion with the Glebe, called the Glebe Sugar Refining Co. 1929) Ltd., with a nominal capital of £50,000. Mr. JOHN WINGATE, the head of the Westburn Sugar Refineries Ltd., is the new chairman ; the other members of the directorate are Mr. J. REID KERR, Mr. JAMES M'CREA, and Mr. HUGH C. WALKER of Greenock, and Mr. G. V. TATE and Mr. J. B. CRISPEN of London. In other words, the new board of directors consists of existing directors of the Walker, Westburn, and Tate & Lyle refineries.

The Cuban Sales Syndicate.

As we briefly mentioned last month, a private combination to control the export of sugar in Cuba was started about six weeks ago. This organization, termed the Joint Foreign Sales Syndicate, is a voluntary association comprising all the American interests producing sugar in Cuba, and has in view the control of the sale to Europe and elsewhere outside the United States of about 900,000 tons of sugar. These interests at present number some twenty or more, and include such big producers as the Cuba Cane Sugar Corporation, the Czarnikow-Rionda Company, the Cuban-American Sugar Company and the Atlantic Fruit Company. The Planters' Association is reported to be in agreement with the scheme which it considers a safety valve to relieve the glutted market pressure on the Cuban industry. The Syndicate state that it is not their policy to unduly press sugars for sale, but to sell in an orderly manner and in a co-operative way. According to Willett & Gray, it is estimated that the Syndicate had sold 100,000 tons of sugars by April 18th. They were then offering 9s. 6d. c.i.f. U.K. ports, which was a harder price than the U.K. refiners were out for at the time. It would seem then that the Syndicate will justify its existence.

The Trinidad Sugar Estates in 1928.

According to the statement of the chairman of the Trinidad Sugar Estates Ltd. at its annual meeting last March, the excellent weather conditions which had prevailed during the year under review had given the estate a record crop. The tonnage of cane showed a substantial increase, being 73,895 tons, as against 61,809 tons in the previous season, and they had produced 7450 tons of sugar, as compared with 5414 tons. Last year 9·91 tons of cane produced one ton of sugar, which compares with 11·41 tons of cane in 1927. Of the canes grown about half were purchased from farmers. The cost per ton in Trinidad owing to the larger crop obtained decreased from £14. 2s. to £12. 1s., but as against that the price obtained for the sugar fell from £18. 18s. 9d. to £15. 10s. 6d. Hence the net profit for the year, which at £20,814 was only £400 less than in 1927, was only rendered possible by the lower costs achieved due to a larger crop and careful economy.

DEATH OF MR. JOHN LAIDLAW.—The death is announced, at the age of 77, of Mr. John Laidlaw, Chairman of Messrs. Watson, Laidlaw & Co. Ltd., the well-known centrifugal makers of Glasgow.

1928-29 BEET FIGURES IN U.K.—Official estimates of the British 1928-29 beet sugar campaign show that the quantity of roots delivered to the factories was about 1,374,800 tons, against 1,449,152 tons in 1927-28. The average sugar content was 17·32 per cent., against 16·12 per cent. The output of the factories is estimated at 195,000 tons, as against 182,581 tons in 1927-28.

C.S.R. Co.'s RESULTS.—According to a cable message to the *Financial Times*, the Colonial Sugar Refining Company of Australia has announced a record profit for the half-year ending March of £507,000, an increase of £38,000 compared with the previous half-year. The dividend is maintained at 10 per cent. plus a bonus of 2½ per cent. The report states that there has been a diminution in the consumption of sugar in Australia, and that the Company had in hand early this year some 150,000 tons of sugar. The position of the Fiji crop is stated to have been saved by the preferential duty granted by Britain and Canada. A refinery is in course of erection in West Australia.

League of Nations Economic Committee.

The Sugar Discussions.

The consultation of the experts on the sugar industry by a Delegation of the Economic Committee of the League of Nations began at Geneva on April 4th last, under the presidency of Herr TRENDELENBURG (Germany).

In his opening speech, the Chairman welcomed the delegates, noting with satisfaction that nearly all countries particularly interested in the sugar question had accepted the invitation to send experts, and had chosen highly qualified persons whose authority was recognised in the sugar industry throughout the world. He expressed his regret that the United States and Japan had not been able owing to unavoidable circumstances to send experts to the meeting.

The Chairman then recalled that the sugar problem had been brought before the League by a resolution of the Economic Consultative Committee. He also described the conditions in which the Council had referred the question to the Economic Committee. He added :—

" The Economic Committee's task is, therefore, a two-fold one : to undertake a thorough study of all factors and measures influencing the production and consumption of sugar " ; secondly, to prepare a report to the Council " in order that the latter may be able to judge whether concerted international action could further the solution of the problems under consideration.

" In order to fulfil its mission, the Economic Committee first obtained information concerning the world aspects of the sugar problem. In conducting this enquiry, it was careful to obtain all possible guarantees with a view to obtain a short but complete and objective summary of the situation. The Committee asked its members and the Governments of certain countries not represented on the Committee, and the International Institute of Agriculture at Rome, to assist it in collecting information and statistics regarding the various points of detail. The Committee then requested a number of experts of recognised standing to prepare memoranda on certain questions.

" The Economic Committee examined the memoranda at its January Session and arrived at the following conclusions :—

> Taken together, these papers reveal the fundamental idea that the present situation of the sugar industry throughout the world is essentially due to lack of equilibrium between production and consumption. Hence, the natural conclusion is that, to re-establish equilibrium, either an attempt must be made to increase consumption or production must be reduced or both solutions must be sought.
>
> It would be questionable whether it would be consistent with the rôle of the League of Nations to take any action with the object of checking the natural development of production, i.e., of preventing expansion resulting from the free play of economic forces.
>
> The development of world production, however, is partly the result of artificial measures of various kinds for which States are mainly responsible.
>
> An examination of the problem from this point of view would certainly be of great value, as would also a study of the possibilities of increased consumption.

" The Committee feels that it can best consider these various problems in close contact with representatives of the sugar world. It has therefore decided to consult verbally, in the first place, experts from the sugar industry, and then, at a later date, experts particularly qualified in connexion with beet growing. This method of verbal consultation—which resembles the procedure followed by the Royal Commissions in England—has been employed in the last few months in connexion with the coal problem and has given very notable results."

The experts were next invited to make general statements on the position as regards the sugar problem in their respective countries, and a number of them responded by making oral statements to the delegation.

The experts were then invited to reply to certain definite questions with a view to completing the information given in their statements. These questions bore on the following points :—The desirability and possibility of reducing or stabilizing the sugar output by agreement between producers, and the rationalization of the sales ; the principal causes of the difference in the consumption of sugar per head in the various countries ; the effect of excise duties on sugar ; the desirability of organized propaganda with a view to increasing consumption ; the effects of the customs measures laid down by the Brussels Convention ; a scheme for the creation of a central office to distribute and collect information on sugar production.

At the conclusion of the consultation of the sugar experts the Chairman emphasized the value of this consultation, stating that it had enabled the delegation to gain a more complete idea of the problem and to assist the Economic Committee in its task which is to " make a recommendation to the Council of the League of Nations in the question whether concerted international action would be likely to facilitate the solution of the sugar problem." The Chairman added : " It is evident that the League of Nations must be completely impartial both in its policy and in its procedure ; it must take into consideration the interests of all the countries and all the categories of persons interested in the problem. In consequence we shall probably have to proceed to still further consultations and in any case to one of experts concerning the production of beetroot. Furthermore, the Economic Committee cannot lose sight at any stage of its procedure of the interests of consumers whether persons or countries. The discussions of the last few days have shown in the clearest fashion that the problem which is engaging our attention is an international problem which cannot be solved by the action of a single country. Moreover, I think you are agreed that the only international measures which are practicable at the present time to alleviate the situation are not measures which depend in the first instance on government action.

" I wish to emphasize this distinction, for it is of great importance to the League of Nations. The League is an association of States and the only measures it can take are governmental measures. The two principal measures which appeared to enlist the attention of the majority of the experts are of a different order. These two measures are : firstly, a stabilization of production during a period of three or four years ; secondly the making of efforts to increase the consumption of sugar. You expressed the opinion that an agreement between producers is the essential condition of carrying out either of these measures. Now all that the League of Nations can do in the sphere of industrial combinations is to study closely their development. Naturally the prospects in regard to future developments constitute an important part of the facts which the Economic Committee must take into account in forming an idea of the situation and in making its recommendations to the Council."

Following on the Delegation's consultation with the experts, the Economic Committee itself discussed the question of sugar. The Chairman summarized the results of the consultation which has just taken place, explaining that it had been very useful and had enabled the delegation to gain an idea of the situation as well as of the principal interests at issue. As in the case of coal, the situation as regards sugar is marked by a lack of balance between production and consumption. But, while the consumption of coal remains stationary,

the consumption of sugar is increasing. The increase was 3 per cent. before the war and is now 4½ per cent. In the opinion of the majority of the experts, if it were possible to stabilize the sugar production the present surplus would be rapidly absorbed by the consumers and the crisis would be mitigated. The Chairman recalled that the idea of stabilizing production had been favourably received by most of the experts who were going to continue negotiations with a view to reaching agreement. In this connexion he said that it was necessary to allow no doubt to remain as to the League's rôle in these negotiations. The League could assume no responsibility and could take no initiative and must confine itself to following the negotiations in accordance with the recommendations of the Economic Conference concerning industrial agreements.

The Committee finally decided to prepare its report in June after examining the results of the consultation to which it has decided to proceed on the question of beet sugar. It then dealt with the organization of this consultation of beet sugar producers. Experts will be appointed by the Economic Committee assisted by the International Institute of Agriculture in Rome. They will be drawn from Germany, Italy, Czechoslovakia, Poland, France, Netherlands, Belgium, Great Britain, Rumania and the Serb-Croat-Slovene Kingdom, which are the principal beet producing countries. There will also be a few experts from other producing countries.

A Sugar Crisis in South Africa.

By EDGAR P. HEDLEY. Ph.D., M.A.

The question most closely engaging the attention of the South African public in general and the sugar industry in particular is the effect that the German Trade Treaty is likely to have on industry—particularly the sugar industry.

As readers of this Journal know, sugar is the chief industry of Natal, 264,374 acres being devoted to growing cane. Great Britain allows a preference of £4. 3s. 4d. per ton on unrefined sugar of 100 per cent. polarization from the British Dominions and Colonies. Natal exports sugar of 96 per cent. polarization and the preference works out at £3. 15s. 0d. per ton. In 1927 she exported 61,700 tons of sugar, the preference totalling £216,000. No other section of South African producers will be so badly hit by the German Treaty as those engaged in the sugar industry. Great Britain provides a vast market for our products, yet the Treaty proclaims, through Germany, to the world, that Great Britain is a foreign country. It is utterly impossible for South Africa to obtain special treatment, customs, or otherwise, from England under this Treaty : she must automatically fall in line with the sixty other nations who have the same favoured nation treaties.

The Natal sugar industry was looking for an increase in the preference upon sugar exported to Great Britain, as great progress has been made in the campaign for a free breakfast table—as it is called in England—and the sugar industry hoped that Natal sugar would be admitted into Great Britain free, and that South African sugar would have had a greater preference in the British market than it enjoyed in South Africa. With such a preference, there was no limit to be set to the expansion of the Natal sugar industry. But the Trade Treaty with Germany has not only struck a blow at the hopes of an increased preference, but has jeopardized the continuance of the existing preference.

The history of the events which have led to this state of affairs is as follows. It appears that on September 1st, 1928, the Union Government and the German Empire entered into a Treaty of Commerce and Navigation but did not disclose the fact in the Gazette for at least two months. As soon as the matter was made public by this action protests were made to Parliament by the Chambers of Commerce of the chief towns of South Africa, viz., Johannesburg, Durban and Cape Town. Meetings of protest were also held all over Natal by the mayors of the principal towns, but in spite of the enormous opposition which this Treaty aroused—and nothing has created so much storm in the country, with the exception of the Flag Bill, since Union was concluded—the Government forced the issue through the Lower House and refused the Senate the right of considering it. A serious position has thus arisen in South Africa—serious from two points of view, the one political and the other industrial, and both are of interest to all members of the British Commonwealth of Nations.

Politically, by this action the Union Government are attempting to create a very dangerous precedent and one which is contrary to English usage, for it has been laid down by constitutional practice in Great Britain that any treaty which effects a change of law, or of the personal rights of the individual, or lays a financial charge on the people can not be entered into by the King without being submitted to Parliament. Moreover the Act of Union No. 36 of 1925 also provides that no agreement of such a nature shall have effect until approved by both Houses; again the Constitution of South Africa lays it down that the legislative power of the Union is vested in the King, a Senate and a House of Assembly. On March 13th, the Senate by resolution expressed its disapproval of the Treaty. Nevertheless, the Government intends to ignore this vote and to proceed to obtain the King's signature. As already stated, this action has roused a *furor*, especially in Natal and Zululand, the seat of the sugar industry. The Leader of the Opposition—General Smuts—realises so clearly the disastrous effect that this Treaty is likely to have on South African industries and especially the sugar industry, that he has stated at a public meeting that if he is returned to power at the coming elections—June 12th—he will immediately take steps to repudiate the document.

Industrially what does the treaty mean? It means that South Africa will have her hands tied, for she cannot enter into any agreement, either with another country of the British Empire or with a foreign country, without the terms of that agreement automatically applying to Germany. Further, South Africa could not apply the dumping duties provided for by the Customs Act to German goods, because in the terms of the Treaty, she undertakes not to discriminate against German products. That is the point; if this Treaty finally becomes law the door is then open for Germany to dump all sorts of surplus commodities into South Africa, and thus the nascent industries of the country, such as sugar, cement, boots and shoes, iron trades, etc., will be ruined, and all this without a *quid pro quo*, for when asked repeatedly in the House to point to the advantages which South Africa receives under the Treaty, Mr. BEYERS, the Minister in charge of it, could point to none.

SUGAR MACHINERY IMPORTS INTO SOUTH AFRICA.—According to *Commerce Reports*, the following are the values of the sugar machinery imported into South Africa during 1926 and 1927 respectively. From Great Britain, £196,191 and £95,575; from Germany, £71 and £400; from the United States, £20,554 and £16,040; the totals being £218,557 and £116,246.

Some Economic Considerations on the Cuban Sugar Industry.

By EARL L. SYMES.

At the Cuban Technologists' December 1928 Conference in Havana, various government officials addressed the opening meeting; encouraging the scientists to strive for a bigger and better Cuban sugar industry. Nearly everyone agrees that it should be better, but that it seems to be big enough for the present. Governmental co-operation was offered, and it was suggested that additional Sugar Experiment Stations be established in each Province. This idea met with little enthusiasm, one reason being that the cost of this work was to be defrayed by collecting an additional tax of one cent. per bag of sugar produced. It was also felt that something should be done about consumption of sugar; in fact, the establishment of Experiment Stations to increase the consumption of sugar would meet with more favour.

At the present time more than half the mills are supporting the Cuba Sugar Club Experiment Station at Baragua, which is doing excellent work. In fact every cane planter and mill owner on the Island is benefited in some way by its work, and each one should lend his enthusiastic moral as well as financial support to this Institution. Better field yields and reduced costs may be obtained by planting new varieties recommended by this Station and its co-operating members. The results of experiments and investigations made by the staff of the Baragua Station are being published in both English and Spanish and distributed by the Cuba Sugar Club. Complete files of these Bulletins and Scientific Papers should be in the library of every sugar mill and cane planter.

Science has been defined as classified knowledge with explanations of causes and effects; the practical application of this knowledge is *Engineering*. This field is usually sub-divided in three sections in the Sugar Industry, *Agricultural*, *Mechanical* and *Chemical*, as found in cane cultivation, milling, and sugar fabrication. However a fourth section, usually omitted, but now more than ever in the limelight, is the *Commercial* division embracing accountancy and marketing. The *Engineering of Marketing* is equally as important as the engineering of making. In view of the recent low prices in the sugar world, most observers would place the section of marketing ahead of all the others. If it is not carried on successfully no profits above the cost of making are secured, and funds for the improvement of field and factory methods are difficult to obtain. It seems quite proper to include *Commerce* among the branches of *Engineering* serving the sugar industry, in view of the fact that the present and former Secretaries of the United States Department of Commerce are engineers. Its work is based on the collection and classification of financial and statistical information, which, when compiled into suitable accounts and tables, serves as a guide for the efficient management of the Commercial section. Factory and field data are continually being gathered and published, the variance of these figures from others of higher efficiency is noted and efforts made to increase the yields of cane and sugar per unit area and the extraction of sugar per unit cane. All of this increased production is now available, but since few or no actual results have been obtained from efforts to increase consumption, it is up to the Marketing Division to get busy.

A brief comparison of consumption data may indicate aching voids that might respond to proper developments. Recently published figures show the following variation in consumption of sugar *per capita*, wholesale prices, and import duties or other taxes.

Country	Rate lbs.		Price cents.		Duty cents.
	GROUP ONE.				
Hungary	24	..	9·04	..	5·71
Spain	20	..	12·09	..	7·44
Greece	20	..	9·02	..	4·56
Italy	16	..	15·95	..	12·16
Average	20	..	11·52	..	7·46
	GROUP TWO.				
Australia	123	..	7·94	..	2·02
U.S.A.	104	..	5·54	..	1·76
Canada	102	..	6·32	.	1·77
Britain	90	..	6·62	..	1·76
Average	104	..	6·60	..	1·83
	GROUP THREE.				
Japan	27	..	6·65	..	2·00
India	25	..	4·77	..	1·46
China	5	..	7·00	..	0·31
Siam	18	..	7·00	..	0·10
Average	19	..	6·35	..	0·97

There is also a fourth group that admits sugar free of duty including Aden, Bermuda, Ecuador, Hongkong, Macao, Federated Malay States, Straits Settlements and Netherlands. Some of these may have begun to levy import duties recently, as the general world tendency seems to be toward raising money by taxing sugar and to increase the taxes as more money is needed. A Research Committee might be able to devise other methods of raising revenue or demonstrate that lower taxes would lead to increased sugar consumption with a corresponding greater volume of tax collections. It may also be demonstrable that increasing the consumption of a 100 per cent. energy food such as sugar would stimulate industrial and other activities of the citizenry and thus add to the national wealth.

It is obvious from a study of the above tables that high taxation is holding down the consumption of sugar in the countries of Group One. The general European *per capita* consumption including these low examples is about 40, and if their rate could be built up to this level an outlet for an additional 500,000 tons of sugar might be found. In Group Two we find the consumption at a high level and the taxes at a medium figure compared to those in Group One. It is sometimes estimated that the present high limit of consumption is about 125 lbs. of sugar *per capita*. Efforts are now being made in some of these countries to increase the use of sugar, but it is apparent that the possible increase is small when compared to the 100 lb. difference between this saturation point and the present consumption rate in Groups One and Three.

The outstanding example of low consumption is found in Group Three, where China is listed with only 5 lbs. of sugar consumed *per capita* per year. This ranks 20 lbs. less than the average of Japan or India and 120 lbs. less than the assumed saturation point. Considering the great population of China, estimated at more than 400,000,000, the potential sugar consumption is tremendous. If the consumption could be built up to the level of Japan and India, an increase of say 20 lbs. *per capita*, the additional sugar required would be 3,500,000 tons. Low buying power, high transit taxes, and poor transportation facilities are said to be retarding the expansion of this market.

Some Economic Considerations on the Cuban Sugar Industry.

The possibility of developing the Chinese market to absorb more than three million tons of sugar should certainly interest the Cuban producers, as this is more than the U.S. market has taken in the past year. It should be easier to raise the consumption of China 20 lbs. than to increase that of the U.S. by a similar amount; since it is well known that as production or consumption nears its high limits, further increases are secured only at a much greater expenditure of stimulants. Opposition to increasing consumption in the U.S. is also placing an artificial barrier in the form of cigarette advertising against sweets and efforts of Child Welfare workers to teach children to eat less candy. Cuban raw sugar can only be placed in the U.S. market after paying $1·76 duty and shipping expenses, making a total of at least $1·9 per 100 lbs. It should be possible to place Cuban raw sugar in Chinese ports for about half this amount, considering the Chinese duty as 0·31 and shipping expenses of say 0·64, or a total of $0·95 per 100 lbs. This large difference, amounting to more than $50,000,000 on three million tons, should convince the Cuban producers that an immediate and thorough investigation of the Chinese sugar trade should be made in an effort to find a greater outlet for Cuban sugar.

Cuban production figures for the first two months of the 1929 crop total more than 2,500,000 tons of sugar with over 700,000 tons produced in the first half of February. The productive capacity is therefore greater than 6,000,000 tons in a four-and-a-half month grinding period. Present low prices will tend to reduce production in this and succeeding crops, eliminating some of the high cost and less efficient producers. However, the productive capacity will remain about 6,000,000 tons and lessons learned during the past three years, when restriction brought the output down to 80, 75 and finally 67 per cent. of this high limit, indicate that an important factor in low cost production is operation at the highest possible capacity. U.S. refiners are able to work at 60 per cent. capacity due to their control of refined sales prices, whereas Cuban producers are unable to fix profitable prices for their raw sugar. Since limiting production failed to secure co-operation from other producing countries, Cuba must now try to develop new markets for her sugar, and should receive the enthusiastic support of other producers in her attempt to increase consumption.

It has been shown that China offers a fertile field for this expansion, and while its position across the world from Cuba at first seems a great obstacle, attention has also been drawn to the price advantage of 95 cents per 100 lbs., due to low tariff rates as compared to U.S. charges. If Europe and the U.S. are considered natural markets for Cuban sugar, the entry of nearly a million tons from Java and the Philippines during 1928 into these markets displacing Cuban sugar, and neglecting their own natural markets in the Far East, will

IMPORTATIONS OF SUGAR INTO CHINA.—*Long Tons.*

Year	Brown	White	Refined	Total
1924	114,872	153,127	261,390	529,389
1925	132,814	280,860	272,205	685,875
1926	115,180	243,810	309,775	668,365
Average 3 years	120,955	225,932	281,120	627,543
Per cent. each grade	19	36	45	100
	1925	1926	1927	1928
CUBAN EXPORTS TO CHINA	23,300	123,000	55,224	14,017

compel Cuba to invade the Pacific consuming centres. A glance at recent sugar trade statistics will give an idea of the nature of the Chinese market.

It will be noted that three grades of sugar are taken by the China trade and that nearly half the imports are refined sugar, mostly supplied from Hong Kong. Now that England takes less refined sugar, China is probably the largest importer of this kind of sugar in the world. Java supplies most of the plantation whites, and the browns or muscovados may come from either Java, Cuba or the Philippines. Early in 1929 England began shipping refined sugar to China, some of it probably produced from Cuban raw sugar. Refined sugar can be produced in Cuba at a lower cost than any product of distant refineries, and all refined sugar entering world trade should be produced and shipped as such from Cuban mills. At least 30 per cent. of Cuban sugar should be available as refined sugar at its shipping ports. This should remove the great weight that depresses the raw sugar values. The remaining 70 per cent. would be available for the regular refining trade in the U.S., Canada and Europe. It is wasteful to think of refining anywhere but on the plantation, now that new methods have made this quite practicable. Factories with good shipping facilities and a plentiful supply of bagasse are the ones indicated to produce this refined sugar. Great shipments of raw sugar to China could not be made unless additional refineries were in existence there to take care of the refining and marketing. There are eight or more small refineries now in China, and the Cuban producers should arrange to lease or otherwise control these small units so that they would use Cuban raw sugar and gradually build up the consumption with their marketing forces. Instead of expanding these refineries when demand increased, Cuban refined could be shipped and handled by the existing marketing organization. The latter could be made up of Chinese with Cuban experience, as there are more than 80,000 sons of the Celestial Empire in Cuba, nearly all in commercial enterprises and many engaged in the candy business, slowly accumulating a fortune to take back to China. Probably most of them would be delighted to return to China with a chance to work for Cuban wages selling sugar and candy to their countrymen. Sugar is the world's cheapest 100 per cent. food, and if the Chinese buying power is low, an exchange of sugar for rice or beans which are imported by Cuba in large quantities might be feasible. The transport airlines may solve some of the carrying difficulties. Cuba carries on a large trade with the Far East, buying sugar bags, rice, beans, etc., but as only small amounts of sugar have been sold in return, the trade balance has been unfavourable during the past few years, as will be seen from the following data :—

THREE YEAR AVERAGE VALUE IN DOLLARS OF CUBAN TRADE.

Far East.			*Nearby.*		
	Cuban			Cuban	
Country	Imports	Exports	Country	Imports	Exports
China	952,269..	3,723,064	Mexico	7,096,514..	41,288
Japan	936,750..	2,179,912	Uruguay	4,531,600..	486,913
India	16,208,875..	128,815	Spain	11,739,648..	1,567,601
Siam	419,322..	3,000	France	11,917,219..	5,290,083
Totals	18,517,156..	6,034,791	Totals	35,284,981..	7,385,885
	6,034,791..			7,385,885	
Unfavourable Trade Balance	12,462,365..			27,899,096	

India, alone, in the Far East group has an average trade balance against Cuba of more than $16,000,000 for each of the three years 1925 to 1927; however, the total is reduced by the purchases of China and Japan. India imports more than 500,000 tons of sugar every year, mostly from Java, but a

commercial agreement might be reached so that ships bringing rice and bags might take some Cuban sugar in return. In the nearby group, Spain is the outstanding example with more than ten million dollars average over the three years collected from Cuba. This was one of the countries in the high tax group, where sugar consumption was being held down by government collections of more than seven cents a pound. Uruguay also has gained more than four millions per year due to its trade with Cuba, and although importing nearly 40,000 tons of sugar per year, more than half is taken from U.S. refiners and little if any from Cuba. The recent shipments of more than 100,000 tons of refined sugar from England to the Far East draw attention to the fact that direct consumption sugar is of much more importance in the world markets than Cuban 96° raw sugar.

The quantity of refined sugar exported from Cuba is increasing gradually, but most of it is being thrown on the U.S. market with little attention to possible demand in other markets. The following table will show amounts of raw and refined sugar exported from Cuba during the past three years.

EXPORTS OF CUBAN SUGAR.—*Long Tons.*

	1926		1927		1928	
	Raw	Refined	Raw	Refined	Raw	Refined
To United States	3,803,625	61,426	3,275,407	105,951	2,749,465	200,410
To Others	860,268	8,576	809,584	15,626	1,008,836	14,975
Total Exports	4,663,893	70,002	4,084,991	121,577	3,758,301	215,385
Per Cent to U.S.	81·56	87·75	80·18	87·14	73·16	93·05

These figures are for calendar years taken from Customs House statistics and have been converted from Spanish pounds to avoirdupois. The proportion of refined sugar exported has increased from 0·41 per cent. in 1926 to 5·42 per cent. of the total exported in 1928. However, the ease with which direct consumption sugar is marketed in the U.S. has caused 93 per cent. of it to flow to that market in the past year. If this market should be restricted by a higher duty, the producers of refined might then find similar facilities for this sugar in the world market. A comparison with the grades of sugar shipped by Java will be of interest.

PERCENTAGE OF DIFFERENT GRADES OF SUGAR SHIPPED BY JAVA.

	1925 Per Cent.	1926 Per Cent.	1927 Per Cent.
Plantation White	57·54	60·40	63·90
96° Raw Sugar	21·23	19·70	—
98° Refining Crystals	18·62	17·20	33·50
Low Grades	2·61	2·70	2·60
	100·00	100·00	100·00

The proportion of 96° raw sugar produced in Java has been gradually reduced until none at all was exported in 1927. Almost two-thirds of Java exports are direct consumption sugars. This striking difference in the quality of sugar produced by Cuba and Java must indicate that the world markets that absorb Java's exports do not want 96° raw sugar and whatever sugar Cuba has to sell on the world market, aside from her regular refining customers, should be produced as refined sugar ready for direct consumption. There are thousands of buyers of direct consumption sugar in many countries that would buy Cuban refined if it were offered as such in London or New York contracts for shipment from Cuban ports direct to consuming centres. U.S. refiners would benefit by turning over their export orders to Cubans and thus keep the competing Cuban refined out of their domestic markets.

The average prices for 1928 have been as follows :—

	New York Basis Domestic		New York Basis Export		Cuban f.o.b. Customs Declared Prices
Refined 100 lbs.	5·54	..	3·33	..	3·24
Raw 96° 100 lbs.	4·23	..	2·46	..	2·36
Difference or Margin	1·31	..	0·87	..	0·88

The U.S. domestic margin for 1927 was 1·10 or 21 cents less than that for 1928. If the export business done by the U.S. refiners at a margin of 0·87 was worth while, it is difficult to explain why the domestic margin should have been raised 21 cents over the 1927 figure. This amounts to $4·70 per long ton of refined and, as 4,377,821 tons were delivered by refiners in 1928, a grand total of $20,575,758, over and above the margin of 1·10 in 1927, was taken from the U.S. buyers. The refiners' institution of Golden Rule ethical methods in their domestic sales relations early in 1928 may have brought this about. No extension of this was made to the buying of raws from Cuba; in fact Cuba was required to learn a Golden Text that reduced the polarization allowances on raw sugar contracts in May, 1928, thus deducting more than $400,000 from the receipts for Cuba raws sold during the balance of 1928 to the United States. This reduction amounts to nearly a million dollars a year on Cuba's shipments of raws to the U.S. market. Refined sugar made in Cuba does not suffer any such penalty and this is another reason for increasing the amount of refined exports. The first annual meeting of the Institute members reported a successful year, and considering the golden harvest amounting to nearly $21,000,000 over and above that taken in 1927, only the domestic buyer and the Cuban producer of raws have a right to complain.

In view of the 44-cent reduction that the U.S. refiners were forced to take in order to book export orders in 1928 at a margin of 87 cents compared to the domestic average of $1·31, it would seem better business for them to trade these orders to Cuban refiners and thus eliminate just that much more competition from Cuban refined in the domestic market. Present methods of refining in Cuba may not be able to reduce this margin of 88 cents to build up volume sales in world markets, but newer methods using vegetable carbons and producing refined sugar in one operation should be able to compete anywhere. It was reported that recent large sales of British refined to the Orient were made at a margin of 54 cents. Cuban factories producing refined in one operation should be able to compete even at this low sacrifice margin. The large excess refining capacity in the United States is not in a position to compete in the world trade in refined sugar at such low margins, and the statement that "The excessive refining capacity of the U.S. could be employed to mutual advantage by the Cuban industry in finding world markets for its growing surplus" repeated in several annual reports of a large refiner is fallacious. Toll contracts made by Cuban producers in recent years showed that all the advantage was to the refiner and that such a method of marketing Cuban raw sugar was uneconomic and resulted in heavy losses for the raw producer. The small amount of refined exported from the United States confirms this as the following data will show :—

EXPORTS OF REFINED SUGAR.

	1926		1927		1928
From United States	95·440	..	111,895	..	111,689
„ Great Britain	77·546	..	84·651	..	90·270
„ Canada	133·372	..	87·389	..	23·621
„ Cuba (total)	70·002	..	121,577	..	215,385
„ Cuba (away from U.S.)	8,576	..	15,626	..	14,975

This shows that the U.S. refiners are not the only ones in the world that can take Cuban raws and find a market for it as refined, refuting the statement repeatedly made by one of the large refiners that "U.S. refiners, always the largest customers of Cuba, are the only ones in the world in position to give Cuba an orderly marketing service, based on world wide experience and with an existing international organization." Cuba must produce her own refined from all raws in excess of 4,000,000 tons and find and develop a market for it, without waiting for any benevolent refiners to help.

The demand for Cuba raw sugar is not increasing in the United States and in fact may continue at about the present level fluctuating 10 per cent. above or below 3,000,000 according as the domestic and insular crops are large or small. The increasing production of corn sugar or dextrose in the U.S. is also displacing some of the cane sugar consumption.

The following table will show the consumption of cane and beet sugar in long tons during the past four years in the United States and also some of the larger sources of supply.

UNITED STATES SUGAR CONSUMPTION AND SOURCES OF SUPPLY.

Year	Total Consumption Cane & Beet Sugar	Production of Corn Sugar (not included in Consumption)	Domestic Production Cane Sugar	Domestic Production Beet Sugar	Insular Production Cane Sugar	Cuban Supplies Raw 96° Sugar	Cuban Supplies Refined Sugar
1925	5,510,060	259,000	124,954	887,324	1,554,936	3,659,554	3,530
1926	5,671,335	311,088	70,259	872,815	1,397,182	3,803,625	61,426
1927	5,297,050	404,329	38,596	780,362	1,559,627	3,275,407	105,951
1928	5,542,636	432,000	115,749	1,037,241	1,752,713	2,749,465	200,410

The increase in consumption is less than one per cent. in 1928 over the three-year average 1925-27 and only 32,576 tons more than that of the year 1925 or 0·59 per cent. The production of corn sugar has continued to increase and also that of corn syrup which is not shown here, both displacing cane sugar. The supplies of raw sugar taken from Cuba have decreased steadily with a correspondingly greater amount drawn from the Insular field. Any further increase in tariff against Cuban sugar will stimulate, still further, the production of Insular cane sugar and hold the Cuban shipments down. The cane production in the United States is being re-established on a sound basis with new varieties of cane, and a part of the production so allied with the bagasse board industry that sugar will be almost a by-product of this synthetic lumber. The commercial production of levulose is also a possibility; being sweeter than sucrose it would displace a correspondingly greater amount of cane sugar than dextrose or corn sugar which is not as sweet as sucrose. All of these factors tending to reduce or prevent a large increase in the U.S. requirements for Cuban sugar must be taken into account by the Cuban producers and immediate efforts should be made to find and develop other markets.

Recent conferences held in Havana on the utilization of bagasse and molasses have been very instructive, and experiments on the manufacture of lumber and paper from bagasse have been carried out. The Cuban government should arrange to take over patents on these products and make them available to all cane producers on equal terms. This would provide a new source of revenue in the form of taxes or licences, that should be quite acceptable.

The Cuban sugar industry has been developed along modern mass production lines, with little or no accompanying modernization of selling methods. Exhaustive scientific research has been applied all over the world to increasing

sugar production, and probably less than 10 per cent. of this expenditure has been dedicated to efforts to increase the consumption of sugar. The motor industry would be insignificant in world trade to-day if such methods had been used in its sales promotion ; it has built up assembly plants and distributing organizations in many parts of the world doing much missionary work in developing markets. Cuba must renovate its marketing methods and apply high-pressure salesmanship to build up large volume trade that will absorb the great sugar crops. Refineries may be leased in countries where consumption is low and distributing organizations formed that will expand the demand for both raw and refined sugar from Cuba. China has been shown to present great opportunities, especially since the recent abolition of interstate transit taxes and the prevailing low import duties of 31 cents on raw and 43 cents on refined.

The present day price of sugar is too low, below the cost of production in Cuba. Single selling combinations, schemes to hold sugar off the market and Government interference will not raise the price as long as the sugar is in existence and has no place to go to. Plans to build or lease refineries in the U.S. are absurd, as the idle refining capacity there is already 50 per cent. in excess of the present needs. Transfer of some of this idle equipment to Cuba might help, but keen world competition at low margins can only be met by producing refined in one operation from the cane and greater utilization of present waste products. Fears that China will develop her own sugar industry are groundless, as such vast outlay of capital would be difficult to obtain considering the great investments already made in Java and Cuba. Necessity for a low cost of living in China would prevent high protective duties. The present Cuban Sugar Export Corporation can be re-organized with energetic sugar producers in control and carry on the necessary investigations in co-operation with the government and its new commercial treaty with China and other countries. Application of existing knowledge to field and factory problems and the injection of modern engineering methods and scientific research into the all-important marketing muddle and concentration on expansion of consumption should enable Cuba to maintain its production at efficient capacity and secure profitable prices for its sugar.

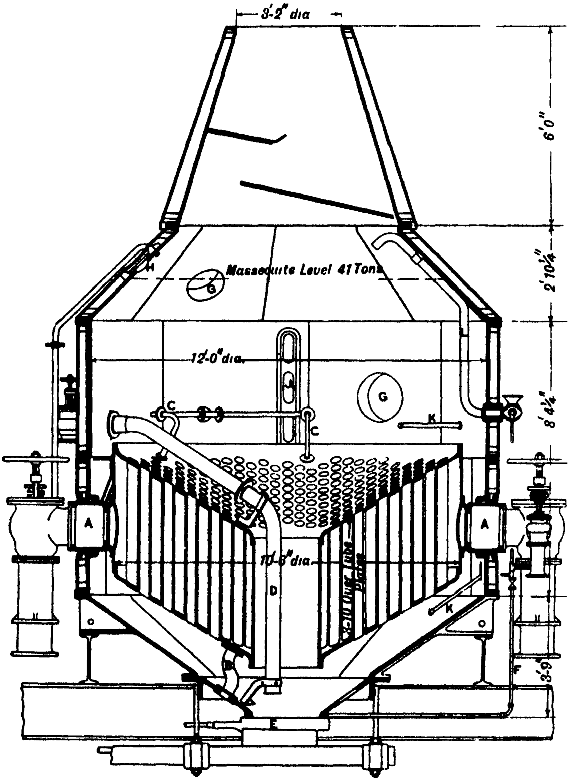
DUTCH SUBSIDY ON SUGAR.—According to Czarnikow, the proposal to grant a subsidy to the Dutch sugar industry has been passed by the Second Chamber of Holland, and will shortly come before the First Chamber for ratification. It is based on the amount the average price of granulated in Holland for the 12 months from next September falls short of Fl. 17 per 100 kilos., but in any event will not exceed Fl. 1·50 per 100 kilos. Thus if the average price works out at Fl. 15·50, the full amount of the subsidy would be granted. On the other hand, if the average price proved to be as high as Fl. 17, no subsidy would be payable.

DE VECCHIS PROCESS.—It is reported that De Vecchis (Foreign & Colonial), Ltd. and Sugar Beet & Crop Driers, Ltd., are to be merged into a new company, to which the public will be invited to subscribe for 100,000 preferred ordinary shares of £1 each and the same number of deferred ordinary shares of 1s. each. Referring to the Oxford process, Mr. Alfred Wood, Secretary of the British Beet Factories Committee has remarked : " All these claims have to be proved commercially. The balance sheet of the company has not yet appeared in the White Paper required to be placed before Parliament in accordance with the British Sugar (Subsidy) Act. The only figures of production which have been authoritatively published, namely 113 tons of sugar and 219 tons of molasses (see *Hansard*, November 22nd, 1928), lend no support to the claims made." He added that his Society could not advise changing over to this process until it had been thoroughly tried out with success on sufficiently large commercial lines, and had been proved to be more economical than up-to-date modern processes at present in use in Europe and America.

An Improved Calandria-Type Vacuum Pan.

A new design of conical type calandria vacuum pan has lately been introduced by Messrs. George Fletcher & Co. Ltd. of Derby, which, it is claimed, entirely overcomes the defects of the older type of pans fitted with horizontal tube plates. In this new pan the heating portion is arranged as a single and separate unit with a coned upper tube plate to facilitate the discharge of the contents of the pan and a coned lower tube plate to eliminate any dead space that would hinder the circulation.

The illustration shows a recently built pan of this type of an internal diam. of 12 ft., and a maximum capacity of 41 tons of massecuite. The calandria itself has a diam. of 10 ft. 6 in., and it is furnished with 435 brass tubes, 4 in. external diam. and of a mean length of 3 ft. 10 in. The steam supply is provided by two low-pressure valves, 11 in. diam. and two high-pressure valves, 4 in. dia. It will be observed that, whilst the tube plates are coned to an angle of 30° from the horizontal, the tubes are arranged vertically. This particular feature presented two workshop problems, viz., that of boring the tube holes at an angle with the face of the cone, and that of expanding the tubes, both of which, it is claimed, have been successfully solved. A further feature of the pan is that the whole of the calandria, of which the body and tube plates are of mild steel, has been sprayed with metallic zinc to prevent corrosion.



The body of the pan, which is of cast-iron, is constructed of parallel and conical belts or rings, each formed of eight segments, with the exception of the lower section of the bottom and the conical head box, which are cast whole. The head box is provided internally with baffle plates to prevent entrainment of the sugar particles or syrup with the outgoing vapour.

In addition to the heating tubes, the calandria is fitted with a central circulating tube which materially assists in the discharging of the contents of the pan, and it is carried by three heavy angle-steel brackets riveted to the shell and resting on brackets cast on the lower ring of the belt. Steam enters the calandria by means of the two connexions *A*, which, to accommodate differences of expansion between the calandria and the body of the pan, are passed through stuffing-boxes arranged in the walls of the latter. The

condensed water passes out through the pipe B to a trap, whilst air or incondensible vapour escapes through the pipes C.

Syrup enters through the pipe D and the contents of the pan are "struck" through the outlet valve E. The valve employed with this pan, which is faced with india-rubber, has been patented by Messrs. Fletcher, and its special feature is that it is opened by being drawn vertically from its seat and moved to one side, and closed by being replaced centrally under the seat and forced up vertically to make a tight joint. All these operations are effected by one hand-wheel arranged on the platform carrying the pan. Should the sugar crystallize into too hard a mass at the bottom, and thus cement the valve to its seat, steam can be admitted by the pipe F to soften it and free the valve.

There are several other fittings to which attention may be drawn, including manholes G for access to the pan; light and sight glasses H and J for observation of the process of boiling; proofsticks K; air admission pipe L, to break the vacuum before the contents of the pan can be discharged; steaming-out connexions, internal washing jets for the sight glasses, pressure and vacuum gauges, etc. The pan belt, coned top and head box are lagged with hair felt covered with wood strips, which latter are secured by brass bands.

Recent Work in Cane Agriculture.

POJ 2725 IN TUCUMAN. THE POJ 2725 SUGAR CANE. **W. E. Cross.** Translated from the *Revista Industrial Y Agricola de Tucuman*, Vol. XVII, No. 10, March, 1927. (With fourteen Tables of analyses).

This seedling was introduced into Tucuman in 1919, largely because of its immunity from mosaic. Its ancestry is summarized by the author, as having as parents, on the one hand the north Indian Chunnee, father of POJ 36 and 213, and on the other a strain of Kassoer which is a semi-wild Java cane with low sucrose and heavy tonnage but apparently completely immune from mosaic.[1] POJ 36 and 213, it will be remembered, are attacked by this disease although tolerant of it. The author describes POJ 2725 as a thick cane of light green colour and with wide leaves; it is straight in growth and if properly cultivated ratoons very well and gives an excellent stand. The new seedling was rapidly propagated, so that a whole "row" was planted in 1921 in comparison with rows of other varieties including POJ 36 and 213. The "row," we learn, is the unit of the cane planters in Tucuman, being approximately 100 metres in length.[2] This plot was continuously cultivated till 1926, and the results of the three POJ's are given in Table I. The yields of canes and sugar of POJ 2725 compared favourably with the two standard canes mentioned; and the new seedling remained free from mosaic although all of the other varieties grown in the plot were attacked.

A larger plot was planted in 1922, on poor soil with irrigation, and this also was continued till 1926, only two or three plants of POJ 2725 showing signs of being attacked by mosaic. Owing to these favourable results a series of further tests was decided on, for the double purpose of obtaining data on production and the character of the juice, and of building up a sufficient quantity of seed cane for wide distribution if this was decided on.

[1] See genealogical table in *I.S.J.*, 1927, p. 66. [2] *I.S.J.*, 1929, p. 131.

By planting a certain number of rows each year in a special plot, it was thus possible in 1926 to reap first, second, third and fourth ratoons at the same time and to compare the results. Presumably this plot was irrigated, for in the next year another plot was planted "without irrigation." Various other plots were laid down, of which perhaps the most interesting was a rotation experiment in 1924. The field had been under cane for many years, and was divided into four sections in 1922, two of which remained under cane, while the other two were treated for two years with green manuring crops, No. 9 clover in summer and vetch in winter, thus having four applications of green manure. POJ 2725 was planted all over the field in 1924, and the crops in 1925 and 1926 compared, with not far off double the weight of cane and sugar from the green soiled plots.

The results of these various experiments show that POJ 2725 "gives a high cane production per hectare with satisfactory sugar content." Its resistance to mosaic as compared with POJ 36 and 213 makes it evident that the planters can with little trouble keep large blocks free from mosaic, and thus obtain complete control over the disease. Weekly analyses showed that POJ 2725 ripened as early as the others with perhaps somewhat superior sugar content. The behaviour of this cane after cutting was markedly different from that of POJ 36 and 213, in that there was little deterioration of the juice. Weekly analyses made for a month after cutting the cane showed that POJ 36 deteriorated to a greater extent in one week than POJ 2725 in one month, this character being apparently shared by the Criolla cane of the tract. Loss in weight was also much less in POJ 2725; and the amount of fibre is less, making milling easier but less fuel available. Harvesting is improved because there are fewer canes to handle, and the lower leaves tend to become detached of themselves. The remaining question of the resistance of this Java seedling to severe frosts has not been decided, but the light frosts of the past few years do not appear to have affected it adversely.

SUGAR CANE EXPERIMENTS AT ALLAI (CEYLON). **F. A. Stockdale.** *Tropical Agriculturist*, Vol. LXXI, No. 6, December 1928.

This paper gives a brief report on experiments in cane growing in the Trincomalee district in the north east of Ceylon, which were commenced in 1925 on the recommendation of a Commission appointed to submit proposals for the development of the resources of the Colony. An area of five acres was cleared and prepared for cultivation during the north east monsoon, the object being to ascertain experimentally whether sugar cane could be cultivated as a commercial crop in the tract. The period of planting up of this area extended from about November, at intervals, till the following October; and as a result it was determined that the best time for planting was during the dry weather in the middle of the year, so that the plants would be well up by the onset of the north east rains. Irrigation was provided by a Persian wheel, and was found to be necessary at regular intervals from March to September. The plots were manured with suphate of ammonia.

The growth of the canes is reported to have been very good, neither pests nor diseases were very much in evidence. Harvesting commenced in 1927 and extended from July to October, the canes being fully matured. "Canes planted in May to July and irrigated are ready for harvest in the following July to September, but growth is vigorous at other times of the year and juices suitable for sugar manufacture." Jaggery was made according to the usual Indian method and caused no difficulty. The canes were ratooned and again harvested in July to September, 1928; and a Table gives the respective

yields of the ten varieties grown. Of these Barbados 208 appears to have been the best, 14 tons of cane producing 1·3 tons of good jaggery; but this cane was found not to ratoon well. The average cut of all the varieties per day was two thirds of a ton of cane which produced one hundredweight of jaggery. The plant canes yielded on an average 35 tons of cane and the ratoons 20 tons.

A Table is given of the analyses of the juice of the different varieties at various periods during the year, some of them being noted by the chemist as not being ready for cutting. "These analyses indicate quite average juices and purities for sugar cane grown under tropical conditions." The profit and loss account of this making of jaggery, furnished by the agricultural instructor in charge of the station, indicates that good profits can be made, assuming a local market for the product.

The author concludes, that, as a large area will be made available for sugar cane planting with the completion of the Veregal irrigation anicut, and imported sugar is taxed, "it should be considered whether it is not an industry worthy of assistance and encouragement." If there is a rotation with paddy he recommends a study of the methods employed in Java. Capital will of course be needed, for Ceylon has passed the stage when jaggery will be consumed in any quantity; and he suggests that this capital could best be attracted from sugar interests in other parts of the world. Before success can attend any such scheme, however, it is essential that the land should be properly drained to prevent flooding; and this will need a thorough investigation when the water from the Veregal anicut becomes a fact. "If the drainage is good, there are decided possibilities before the cultivation of sugar cane in the Allai area."

LOW TEMPERATURE INJURY TO STORED SUGAR CANE. **G. B. Sartoris.** *Journal of Agricultural Research*, Vol. 38, No. 4, February, 1929.

Following the studies on the effect of low temperatures by PEACOCK and WRIGHT on potatoes, and on sweet potatoes by WRIGHT, the author made a series of experiments on pieces of sugar cane such as are used for seed purposes from 1913 onwards, submitting them to various degrees of cold under controlled conditions. The experiments were conducted at Washington during 1923-1924 but, owing to the injury to the buds during transport, after the first year they were transferred to Southdown plantation in Louisiana. The paper is divided up under the following headings: Cold storage experiments, freezing point of sugar cane juice, low temperature resistance of sugar cane, and growth of fungi at low temperatures.

In the first experiment canes were placed in three insulated chambers in the cold storage room, and kept at 3°C, 7°C. and 12°C., while some were exposed to the normal temperature of the room, namely 0°C. The humidity of the air was kept at 95 to 98 per cent. by currents of air circulating over large pans of water. Part of the canes was treated with hot water before storage and part after storage but previous to planting. The varieties tested were Louisiana Purple and Cayana, and the effect of the low temperature was judged by the percentage of germinations on planting out in the greenhouse. The cane kept at 3°C. did not germinate, and that at 7°C. did better than that at 12°C. Hot water treatment was successful, the best germination being obtained where this was applied before storage; and hot water treatment in spring was better than none at all. This method also gave better results than 20 mins. with fungicides, besides being more practicable and less expensive.

In the succeeding year larger chambers were used, in which the temperature was kept at 6°C. and at 9°C. The varieties tested were D 74 and D 95, and the canes were divided into upper and lower halves, these being treated separately. These portions of cane were cut into convenient lengths and stored in sawdust, which was kept moist by spraying at regular intervals. The results of the germination tests showed that "on the whole, there was no significant difference between the keeping of tops and butts in cold storage, and that the cane treated with hot water, with cold water, and with mercuric chloride did not keep better than untreated cane." None of the treatments in the experiments equalled the ordinary windrowing, and fall planted cane was if anything better still. Thus the experiment showed that storage in the field was the best for the two varieties tested.

In 1925-1926 the most notable difference in methods was the addition of moist earth as a storing material, and in general it was found superior to the sawdust. The varieties tested were, however, D 74, POJ's 36, 213, 234, and Cayana. D 74 gave very poor germination all through, being far behind all of the others and thus bringing down the general averages. Its germination varied between 2·29 per cent. and 4·97, while in windrowed cane it was only 1·50. The percentages of the POJ's under treatment varied between 12·49 and 38·60, there being also one case in twenty-one of no germination which is not explained; and in Cayana ranged from 14·29 to 41·82. The average germinations of the various treatments varied between 18·46 per cent. and 24·40, which was better than windrowed cane (13·4) but lower than the figure 28·93 for fall planted cane (in which D 74 and Cayana were omitted). The final conclusion was that cold storage of sugar cane is not practicable.

The freezing point of sugar cane was known to be about 1°C. below that of pure water; but in order to obtain more exact information, that of the juice in various tissues was investigated, namely, in the base of the stalk, the growing point, the leaves, and the stalk as a whole. The varieties tested were Louisiana Purple, SPI 29109, and POJ's 36, 213, 234, and 2725. The degrees below 0 C. were as follows: Growing point 0·468 to 1·090, lower joints 0·627 to 1·157, leaves 0·575 to 0·814, and the whole stalk 0·72 to 1·641. The author remarks, further, that the lower portion of the stalk withstands more cold than the buds along the stalk: the lower buds are usually a little more resistant to freezing than the growing tip: the amount of cold that they will stand depends to a certain extent upon the protection given by the leaves, and the condition of the soil: in Louisiana the cane on the light soil freezes at a lower temperature than that on the heavy black soils. In further experiments Louisiana Purple showed itself less resistant than POJ 13: buds are usually killed before the roots, and the low temperature retards the development of both: when the buds are dead the roots begin to develop quite soon, but with the buds dead of course no plant can appear and in the experiments the cutting is then considered dead.

In the storage experiments the stored cane showed different degrees of deterioration at different temperatures because of the activity of fungi, most of which are facultative parasites, usually saprophytic and always present in the fields. "The experiments show that all the fungi except Aspergillus grow fairly well at 12°C., and that most of them grow well at 7°. *Botrytis sp.* grows well at 3° and *Colletotrichum falcatum* grows slowly at the same temperature. The only fungus to grow at 0°C. is Botrytis." "It is clear that the range of temperature at which sugar cane can be stored is very small. At temperatures below 7°C., where the growth of fungi is inhibited, the cane is

injured to such an extent that the percentage of germination is very low. At higher temperatures the fungi develop so rapidly that a large part of the cane is rotted. The experiments show that a temperature of about 8° to 10° is best for the storage of sugar cane."

GERMINATION OF SUGAR CANE POLLEN IN ARTIFICIAL MEDIA. **N. L. Dutt and G. Ganapathi Ayyar.** *Agricultural Journal of India.* Vol. XXIII, Part III, May 1928.

For breeding work, as the author observes, it is essential to have a knowledge of the fertility of the pollen; and this is especially the case with the sugar cane. Counting the opened anthers helps, and 60 to 100 per cent. indicates the usefulness of a cane as male parent. But the author observes that the pollen of open anthers may include any percentage of immature and rudimentary grains, which do not germinate. In experiments on germinating the pollen grains artificially there is great diversity, but the factors concerned are not completely understood; in fact, "the problems connected with the physiology of the pollen germination still await solution."

The Gramineae as a class exhibit special difficulties, although some success has been obtained in cases, e.g., maize and barley. The work at Coimbatore thus far has been disappointing, the practice being to germinate the pollen grains in juice expressed from the stigmas of a different plant, *Datura fastuosa*. The use of sugar cane stigmas (as was found at Coimbatore) presents difficulties because of the colouring and minuteness. Among other difficulties encountered in this work are the very short period during which the whole of the canes arrow (two months at Coimbatore), and the variable nature of the pollen that is available, "not only in different arrows of the same plant but also in different portions of the same arrow and, indeed, in adjoining spikelets." The anthers also differ in their time of opening, their size and shape, and their contents.

For artificial germination, different plants require different treatment: some are only dependent on suitable moisture conditions, while others require exact proportions in their nutrient substances. The first point studied was the best way to control the supply of air and moisture, for pollen readily bursts in excess and shrivels in a deficiency of moisture. After trials, a glass ring 7·5 mm. high and 17 mm. across, with one or two drops of culture medium at bottom, was found to be the most satisfactory moist chamber. The advantage of this arrangement was that the vapour pressure was in equilibrium, no water evaporating from below and depositing on the culture medium above, and *vice versa*.

The next problem was the most suitable culture medium. Of the various substances experimented with, with or without agar, only sucrose gave any encouragement. Low concentrations caused the grains to burst, and high induced plasmolysis; and the best results were obtained with 23 to 30 per cent. sucrose solution combined with about 1 per cent. agar. The final technique adopted was as follows "Chemically pure cane sugar (sucrose) is dissolved in distilled water to give a strength of 26 per cent. sucrose, and 0·7 per cent. agar is added. The solution is boiled for a minute or two to dissolve the agar, and cooled again to room temperature. A glass ring 7·5 mm. high and 17 mm. in dia. is vaselined on the top and bottom and placed over the cavity of a hollow ground slide. Two or three drops of the above culture medium are placed in the hollow. A small drop of the medium is then put on a clean cover slip and spread to a thin layer with a glass rod. The pollen is then dusted on the medium and the cover slip inverted over the moist

chamber. The vaseline makes the chamber fairly air proof, which seems to be a necessary requisite. The moist chamber is then left at the room temperature (23-26°C.)." The percentages of germination were calculated with the aid of a micrometer in the eye piece marked out in squares.

(1) *Comparative viability of the pollen of a few cane varieties.*

Seventeen cane varieties were tested, the arrows being cut about one hour before the opening of the anthers and brought to the laboratory with the stems in water. A Table gives the resulting viabilities, as judged by germination in the medium described above. They varied from no success in Louisiana Purple and Red Ribbon to 44 per cent. germination in M 54111 (Madras seedling routine number).

(2) *Influence of temperature on pollen germination.*

Three tests were made with Saretha Desi (an Indian cane) and one with M 54111. These were at three different dates during November and December, and in each case germination was studied at fixed temperatures in the incubator and compared with those at the ordinary laboratory temperature; the former being at 27·5°, 30° and 33°C., and the latter varying between 23°C. and 27°. The resulting perentages of germination are presented in a Table, and the following are the author's conclusions: "There is a wide range of temperature in which pollen appears to germinate normally. The laboratory temperature in the morning varied from 22°C. on chilly days to 26 to 27°C. on other days. Good germinations were obtained irrespective of the changes in temperature. At 27, 30 and 33°C. in the incubator, the percentages of germination and the length of the tubes were as good as at the lower temperatures, but at 30 and 33°C. there was a tendency to burst."

(3) *Influence of weather.*

Changes in weather have a great effect on the dehiscence of the anthers, as is well known. Tests were applied to see if there was any effect on the germination of the pollen, on selected days, with wide differences in wind, sun, shade and rain. The Table seems to show that there was no corresponding difference in germinations, although the percentages varied from day to day.

(4) *Viability of pollen at different periods after dehiscence of anthers.*

Pollen of Saretha Desi was taken from a growing arrow in the field immediately before or at dehiscence, and at half hour intervals thereafter. Germinations were observed in good quantity for two hours after dehiscence, but none before; the percentage was not materially affected for an hour, but fell off later.

Viability was then tested after the pollen had been exposed for different periods of time to the laboratory air at different temperatures, and also to free air in sunlight. In the latter case the temperature of the air was taken. The results were much the same as in the last test. The laboratory air rose from 24°C. at 7-30 a.m. to 26° at 10 a.m. and ten tests were made during this time. The results in the laboratory showed that an hour's exposure had no effect on the viability, but after one and a half hours there was a marked decrease in the percentage, and after two and a half hours there were no germinations. In sunlight the results were approximately the same, but the author considers that these should be confirmed. He points out, in this connexion, that pollen of barley is said to lose its viability completely when exposed to the air for ten minutes.

In the discussion of the results obtained in this study, it is suggested that the variations in the germinating percentages obtained in the same cane variety are caused, not only by the nature of the available pollen, but also

by the delicate adjustment of the external conditions. "The conditions necessary to secure germination appear to be (1) a suitable culture medium and the proper concentration of its ingredients, (2) proper adjustment of moisture, (3) of temperature and (4) of air. To these may be added the age of the pollen, according as it is dusted exactly at the time of dehiscence or at fixed intervals after, the part of the arrow from which the pollen is taken, and the addition of necessary growth-promoting substances." The length of the pollen tubes, about 2 mm., appears to be satisfactory when compared with that of the style and stigma ; two-branched tubes are frequently met with and three-branched also occur. With due regulation of moisture he obtained germinations without the medium ; but as the tubes were thin and not more than 300μ long, he concludes that "the sugar-agar medium either provides direct nutrition to the growing tube or affords a favourable ground for the formation and subsequent assimilation of substances that aid the growth." That the germination of cane pollen is not merely the effect of a balanced osmotic condition but the result of a definite chemical stimulus by the sucrose, is a plausible explanation of the fact that isotonic concentrations of maltose, lactose, dextrose, etc., do not give satisfactory germinations ; and, further, the formation of tubes in the absence of any culture medium adds strength to the view that a balanced osmotic condition is not the only desideratum.

LONGEVITY OF SUGAR CANE POLLEN. **N. L. Dutt.** *Agricultural Journal of India.* Vol. XXIII, Part VI, pages 482-483. November, 1928.

This "Note" may be referred to as an addendum to the paper discussed above, and it has a very practicable bearing on one of the main difficulties in cane breeding technique. DUTT has extracted from the copious literature on pollen certain extreme cases of longevity under storage, with definite relative humidities, low temperatures and so forth. *Pinus sylvestris* pollen was kept good by PFUNDT for 279 days, *Prunus Padus* for 181 days, and *Digitalis purpurea* for 172 days over H_2SO_4. According to KNOWLTON, Antirrhinum pollen germinated after 670 days, and retained its fertilizing power for 161. In comparison with these, grass pollen is very short lived ; corn (maize ?) pollen was kept in sealed tubes for 24 hours, and in 90 per cent. humidity 48 hours : barley pollen greatly decreased in fertilizing power in 24 hours and had lost it in 48. KNOWLTON found that at 5°C. to 10°C., with humidity 50-80 per cent., the maximum retention of fertilizing power was 70 to 80 hours. It will be remembered that VENKATRAMAN approached the matter from a different standpoint, namely, by regulating moisture so that the stamens were prevented from protruding, and thus their dehiscence was inhibited.

DUTT gives two of his experimental results. With POJ 2696 pollen, under partial exhaustion of a desiccator at 9-13°C., he obtained 30 germinations after 96 hours, the untreated fresh control giving 560. With Maur 131 pollen, in sealed and paraffined tubes, he obtained 10 germinations after 168 hours against the control figure of 550 ; the pollen grains were, however, seen to be caked and sticking to the sides of the tube. This of course does not signify viability, but the curious fact is mentioned that in certain cases fertilizing power appears to be able to outlast germinating capacity. The success in storing pollen for seven days is thus an advance on the former gramineous maximum of two to three days, but the problem is to keep it good for four weeks or more, and the investigation is proceeding.

C. A. B.

Second Cuban Technical Conference.[1]

Maintenance of Locomotives and Cars.

F. A. De Wolff outlined in his paper the causes which he considered to be in a great measure responsible for avoidable maintenance expenditures on the plantation railroad. (1) Poor condition of track, causing derailments with their costly effects on maintenance, and in addition excessive friction, resistance and constant strains due to bad track which all affect the cost, are also mentioned. (2) Bad boiler feed water in its effect on boilers and component parts is one of the most costly items. By far the best remedy for this is the use of flax-seed, which appears to have arrested corrosive and pitting action, reduced the formation of detrimental scale, and also, it is stated, diminished the amount of old scale without causing foaming, though time is required to show the value of this addition. (3) Improper lubrication is an important cause, and the mere fact that oils and greases are consumed does not mean that lubrication is efficient. A suitable and properly adjusted mechanical lubricator is the best device to use for steam cylinder lubrication, showing as it does the economy of 25 per cent. in the amount of oil used per 100 engine kilometres, as compared with a hydrostatic lubricator. The usual small oiling holes provided for oiling the wearing parts of spring and brake rigging, and engine truck cradle hangers, are usually not accessible, and are easily fouled. Forced feed lubrication on the lines of the "Alimite" system is recommended, using a heavy bodied oil, instead of grease. Efficient and adjustable feed oil cups for lubricating guides, piston and valve rods are essential.

A sturdy constructed compression grease cup for all rods and wrist pins, properly used, will reduce maintenance costs. As a general rule ordinary cylinder oil, fed through oil cups, is used for lubricating air cylinders of compressors with the result that this oil either carbonizes or forms a gummy substance which is carried over into the delicate working parts of the air brake system, but this practice creates no end of trouble, especially where two-stage compressors are used and should be remedied by using proper lubricators and a high grade air compressor lubricating oil. There are many very good journal box lubricators on the market which are worthy of consideration, but grease lubricators applied to locomotive driver boxes and well prepared saturated packing properly applied will cover the existing railroad requirements. (4) Inferior quality of material is no doubt the predominating factor involved in many costly failures and maintenance items. All boiler and firebox steel plates are now furnished by reputable concerns under strict specifications. Staybolts now being used are made from a high grade refined iron and hold up splendidly. Experience has proven that the usual carbon steel locomotive driver springs will not hold up, and all locomotives are now fitted with chrome vanadium steel springs, some of which have been in constant service for the past three years and are now as good as new. The use of properly designed re-enforced steel back brake shoes has resulted in many benefits, such as a vast reduction in brake shoe renewals, more efficient brakes and the practical elimination of danger as compared with the use of ordinary cast-iron brake shoes. Boiler tube maintenance has been reduced a great deal by the use of the best quality seamless steel tubes of No. 11 B.W.G.; boiler tube safe ends are purchased ready for use, in other words safe ends are ordered to be made of either seamless steel or iron 8 in. long, swedged at one end $1\frac{1}{4}$ in. long, $1\frac{5}{8}$ in. O.D., for 2 in. tubes. No. 11 B.W.G. steel castings are used in preference to cast iron. Brass castings are made of mixtures of known qualities suitable

[1] Continued from page 148 of March.

for the purpose they are to be used for. Structural steel shapes, steel rivets and steel plates corrode very rapidly in the section of country from which this paper is written. Other causes responsible for avoidable maintenance costs which were dealt with by this writer are : Light and weak design ; lack of knowledge and experience in the handling of locos ; make-shift or temporary repairs ; over-loading ; allowing loads to drop into cars ; hauling cars by animal traction with tow-lines hooked into easily-damaged portions of cars ; storage of locos and cars during the idle season without proper protection against weather ; ignoring the importance of proper condition and periodical boiler washing ; and not making repairs at the time defects present themselves.

Cane Transportation Costs.

A contribution by Arturo Tinoco dealt with the management of the huge and costly systems of railroads that are now to be found in Cuba. These are treated as an undertaking which should yield profits, or at least pay for its working, rather than as a secondary branch of the mill, the cost of operation of which formerly could never be stated per kilometer of haul. To obtain the data, the following items should be known : (1) the detailed expenditures of each of the departments shown in the following table ; (2) the ton-kilometer haul during the crop, obtained by knowing the tonnage of all materials moved, including empty cars, and finally the distance covered by such freight ; and (3) the arrobas of cane ground and the bags of sugar hauled. The table gives for the crop of 1927-28 the average costs of transportation of cane, etc., in the case of five large Cuban mills :—

Operation		Average	
	Per 100 Arrobas	Per Bag of Sugar	Per Ton-kilometer
Superintendence	·0084	·0093	·000122
Salaries and wages	·0666	·0729	·001076
Fuel	·0752	·0834	·001139
Oil, Waste, Sand, etc.	·0048	·0052	·000073
Tools and Equipment	·0020	·0023	·000039
Automobiles	·0088	·0075	·000089
Accidents, etc.	·0043	·0050	·000074
Wharf	·0005	·0006	·000003
Railroad Cranes and Shovels	·0011	·0013	·000016
Public Railroad Junction	·0010	·0011	·000055
Proportion Narrow Gauge	·0022	·0025	·000042
Total Operation	**·1749**	**·1911**	**·002738**
Repairs and Maintenance.			
Locomotive Shop Expenses	·0083	·0092	·000123
Repairs to Locomotives	·0139	·0153	·000239
Repairs to Rolling Stock	·0185	·0203	·000317
Repairs to Tracks	·0750	·0931	·001329
Repairs to Bridges and Culverts	·0010	·0011	·000019
Repairs to Telephone Lines	·0010	·0011	·000005
Water and Oil Service Stations	·0016	·0017	·000041
Water and Oil Tanks and Pipe Lines	·0050	·0050	·000000
Total Repairs	**·1243**	**·1468**	**·001053**
Total in Company's Lines	**·2992**	**·3379**	**·003791**
Less Charges to Other Departments	·0702	·0892	·000994
	·2290	·2487	·002797
Add : Other Transportation Charges	·1167	·1292	·002710
Total Crop Expenses	·3457	·3779	·005507
Add : Idle Season Expenses	—	—	·002811
Total Expenses Transportation	**·3457**	**·3779**	**·008318**

Results of Analyses of all Cane Delivered.

D. N. Eaton at Centrales Baguanos and Tacajo has carried out the experiment of having all the cane analysed as to sugar content, finding this to be of such help in controlling the supply as certainly to merit its continuation. He points out that considerable losses occur each year by the grinding of cane, which, while not definitely stale, is sufficiently old to cause the loss of a very considerable sum of money during the crop, generally unnoticed. If only half a point is dropped on a possible yield of say 12 per cent., this is a definite loss to the Company. There does not appear to be any definite rule as to the time that may elapse between cutting and grinding, but three days is a good maximum, though of course some canes will last longer. At the two factories mentioned a first class, fresh cane supply was guaranteed, being made possible only by control measures indicated by the analyses of each car load of cane received at the batey.

One of the instances in which analysis showed a loss of yield from other cause than stale cane was in a case in which it was noticed that of the cars loaded by a certain *colono* one always showed a point less each day, this being later found to be cut in a separate field where the cutters were leaving a considerable amount of *cogillo*, or tops, on the stalks. In short, the system of analyses at the two mills has proved a success, and has made for greater efficiency and economy. Such a system can be carried out at but little extra cost : two men to assist in analysis, two boys at the mills, and two clerks in the agricultural department, one of whom is permanent. If a large area of administration cane is involved, and conditions warrant it, a few extra cane inspectors may be employed for the crop. Since the field proportion of cost in the making of sugar is about 70-80 per cent., every effort should be made to reduce losses at this stage, and the one immediate economy is the delivery of fresh cane to the mills.

Refining Qualities of Raws.

In his paper on this subject, R. C. La Salle pointed out that the refiner has a right to expect a satisfactory raw sugar for his purpose, and that the producer depends as much on the refiner for his profits as the refiner depends on him. The most important physical characteristic is the uniformity and size of the crystals, the desideratum being a sugar that will affine satisfactorily, having crystals hard and sharp, and of an average diameter of not less than 0·6 mm., or over 1 mm. Refiners do not want very large crystals ; their objection is to small, mushy ones between 0·2 and 0·4 mm. diam. A good microscope is invaluable on the pan-floor, since the grains that cause trouble in affining are usually so small as to be invisible to the naked eye or are mistaken for air-bubbles, being detected only under a high power. This has been demonstrated in Cuba, and is in no way exaggerated.

Colour is the second important consideration, especially when there is much colouring matter within the crystal, and when the high colour is associated with bad crystal formation. The most objectionable colour is grey (indicating improper clarification or ferric compounds), and almost of equal importance is the avoidance of the formation of red colouring matter by heavy liming. The most approved colour is bright golden or yellowish brown, which is recognized practically as a good raw, having resulted from thorough clarification and elimination of a maximum of impurities. Control of clarification is notably lax in Cuban centrals, but lately the application of the colorimetric hydrogen ion determination has been found invaluable. Juice should enter the pans at about *pH* 7·0, or slightly higher, and the liming must

be such as to produce the quickest settling and most brilliant liquor. What should be avoided is a turbid juice, and liming should be carried to the point where the colloidal haze disappears, but not so far as to impart a red colour to the juice.

Filtrability is likewise dependent on the process of clarification. Non-settling matter and gums cause in the refinery increased consumption of defecants, the necessity for great filtering area, and loss of time. Poor crystal formation is usually accountable for the high moisture content of raw sugars, as small crystals and irregular grain carry increased molasses film. Such sugars call for excessive washing, because they purge badly. Thus the protective molasses film is destroyed, part of the crystal goes into solution, and fermentation with decrease of polarization follows. This is one of the chief sources of loss to the manufacturer. On the other hand, if the crystal formation be satisfactory, the raw sugars should purge easily, and there should be no difficulty in producing a sugar conforming to a deterioration value of 0·25. Lastly, it should be remembered that good clarification and good boiling-house practice mean additional yields for the raw sugar producer, apart from the gain that results from a higher polarization.

TWO *vs.* THREE MASSECUITE SYSTEM.

J. W. B. ZAALBERG presented a study of the amount of massecuite to be obtained by the two and three massecuite methods of boiling, his calculations being similar to those to be found in GEERLIGS' book,[1] though the latter does not take into account the use of the third sugar as seed. These calculations (which need not be detailed here) show that the 3-massecuite system gives considerably less massecuite per 100 of solids in the meladura or syrup than the 2-massecuite system, excepting when the syrup purity is 80, at which point and lower the 2-massecuite system is seen to be advantageous. As to the pan capacity necessary, this is calculated for the 3-massecuite system, taking the least advantageous case found

Take a grinding rate of 100,000 arrobas daily with 81 normal juice extraction and an analysis of the normal juice of : 20·30 Brix, 16·24 sucrose and 80 purity. In this juice are present 411,075 lbs. solids and (supposing nothing is eliminated during clarification) we find with a meladura Brix of 58·15 we obtain 706,922 lbs. meladura ; 100 solids meladura give 198·36 solids in massecuite, therefore 411,075 lbs. solids in meladura give 815,412 solids in m.c. The detailed calculation shows that we get :—

39·085 m. c. from 39·085 meladura			
111·764 m. c. from 44·875 meladura	48·649 C sugar	and 18·240 miel A
130·393 m. c. from 78·236 meladura		and 52·157 miel A
100·000 m. c. from 30·000 meladura		and 70·000 miel B
381·242 m. c. from 192·196 meladura	48·649 C sugar	and 140·397 miel
198·361 m. c. from 100·000 meladura	25·312 C sugar	and 73·048 miel

411,075 lbs. solids in meladura produce : 815,412 lbs. solids Massecuite, 104,051 lbs. solids 3rd sugar, 150,564 lbs. solids 1st molasses, 149,718 lbs. solids 2nd molasses. Taking the Brix of the 1st m. c. as 93·50 ; of the 2nd, 94·50 ; of the 3rd, 96·50 ; of the 3rd sugar, 97·50 ; of the molasses diluted, 60·0 ; it is found that the 1st massecuite is 345·089 lbs., of the 2nd, 295·102 lbs. and of the 3rd, 221·640 lbs., a total of 861,831 lbs. the 3rd sugar being 106·720 lbs., the 1st molasses, 250,940 lbs., and the 2nd molasses, 249,130 lbs. ; 861,831 lbs. of massecuite occupy a volume of about 9100 cub. ft., and

[1] "Cane Sugar and its Manufacture." Second Edition ; page 228 *et seq.*

adding 10 per cent. the volume of m. c. to be worked up in 24 hours is 10,000 cub. ft. Assuming the duration of a strike as 7 hours, the capacity of the pans needed may be calculated as : $\frac{70,000}{24} \times 100 = 2920$ cub. ft., or 2·92 cub. ft. per 100 arrobas of cane, a lower limit, which may be augmented a little. The water to be evaporated in the pans is 706,992 + 106,720 + 250,940 + 249,130 — 861,831 = 452,281 libras. Calandria pans have as a rule 2 ft. of h.s. for every cub. ft. of capacity and coil pans 1½. This would give 5840 sq. ft. of total h,s. in the case of calandria pans and 4380 sq. ft. total h.s. for the coil pans, or 5·84 and 4·38 sq. ft. per 100 arrobas of cane ground, which data agree well with those found in practice.

Changes in Raw Sugar Polarization Allowances.

W. D. Horne considers the relations between the old schedule of prices to be paid for raw Cuban centrifugal sugars and that put into effect about the first of the current year by the Sugar Institute, and compares them in tabular form, on a 3 cent. basis for 96° grade sugar, as follows :—

Polarization	Old C. and F.	New C. and F.	Polarization	Old C. and F.	New C. and F.
91	2·60 c.	—	96	3·00	3·000
92	2·68	—	97	3·08	3·045
93	2·76	2·817	98	3·12	3·0825
94	2·84	2·892	99	3·16	3·0825
95	2·92	2·952	100	3·20	3·0825

If now one examines the refining values of these sugars, a very close approximation thereto may be obtained by assuming that with the varying polarizations the moisture content varies directly with the total non-polarization in the ratio of 25 per cent., that the defecation and char filtration remove jointly ⅓ of the total impurities, that the refining loss is 1 per cent. of sucrose, and that the final molasses has a purity of 40. Of these reasonable, though of course only approximate, assumptions, the following table can be prepared :

Pol.	Water	Impurities	Imps. after Char	Sucrose in Molasses	Sucrose lost, per cent.	Sucrose Yield	Relative Value	Money Value, c.
91	2·25	6·75	4·50	3·00	1	87·00	92·881	2·786
92	2·00	6·00	4·00	2·67	1	88·33	94·301	2·829
93	1·75	5·25	3·50	2·33		89·67	95·731	2·872
94	1·50	4·50	3·00	2·00		91·00	97·152	2·914
95	1·25	3·75	2·50	1·67		92·33	98·571	2·957
96	1·00	3·00	2·00	1·33		93·67	100·000	3·000
97	0·75	2·25	1·50	1·00		95·00	101·622	3·049
98	0·50	1·50	1·00	0·67		96·33	102·842	3·085
99	0·25	0·75	0·50	0·33	1	97·67	104·272	3·128
100	0·00	0·00	0·00	0·00	1	99·00	105·692	3·170

Comparing, now, these calculated values to the refiner with the prices offered by him, we see that whereas he now offers 3·045 c. for a 97 grade sugar instead of the former price of 3·080, he will pay 2·952 c. per lb. of 95 sugar instead of the former price of 2·92. In each case he is offering just a shade under its refining value when calculated on the above assumptions, but both prices come closer to the calculated values than was the case under the old schedule. The same might be said of 98 and of 94 sugars. At 99 grades the new schedule offers a price 0·0355 c. below the calculated value, whereas the old schedule offered 0·032 c. above the calculated value. At 99 grade polarization the calculated value is 3·128 and the former schedule

offered 3·160, whereas the new schedule offers 2·0825 or the same that it offers for a sugar polarizing 98 grades. There is no apparent reason for this discrimination except that the refiner wishes to discourage the manufacture of such high testing raw sugars, fearing that they may compete dangerously with refined sugar, or that, having learned how to make a 99 grade sugar, the raw sugar manufacturer will go a step farther and make refined sugar himself. There is considerable net economy in the manufacture of 99 grade raw sugars, because the slight extra expense involved in their preparation is made up several times over in their refining—resulting in a possible economy to the eventual consumer.

Boiling Methods and Raw Sugar Quality.

J. L. Catlett outlines methods used in Cuba, in factories where he has been in charge, the object in view being to obtain a maximum money value for the refiner and not the operator who pays for the sugar. Take for granted that the sugar required is one for long storage and to be sold to the refiner, that the operator is skilled as to quantity, we must make a hard regular grain, which under average conditions found in Cuba is very difficult to do. To begin with, graining must be done at a low vacuum and high temperature, (about 22½ in. and 150°F.). This presents the difficulty of poor circulation in the pan which naturally means irregular formation of the grain which is objectionable to the refiner ; however, this may be overcome by having a pan to grain on that has its heating surface well distributed, such as a pan with many small coils, especially in the cone or bottom of the pan, or if a calandria pan is already installed, by putting soils in the cone under the calandria and quick removal of the condensate from the calandria and coils. Along with proper distribution of heating surface and removal of condensate the graining can be hastened and make more regular by using a high purity mother liquor. For instance, if the liquor or syrup is of low purity it can be raised by the use of melted sugar ; a high purity liquor crystallizes quicker and more regularly than a low purity one. This amount of melted sugar is not so large as the average person would think, as graining will not be necessary oftener than twice a day if the seed is properly manipulated. This method the writer will strongly recommend as he has found it highly satisfactory. The results obtained were pleasing to both owners and refiners. It has the advantage of the previous methods in that when the grain is once formed it can be relied upon to withstand the hardships encountered later on, such as sudden drop in vacuum, washing the strike to eliminate the false grain that may appear later in the strike, etc. After the grain is thus caught and receives one or two charges or becomes set, the vacuum must be raised gradually. It is very important that great care and strict attention be paid here until the maximum vacuum attainable is reached, for a sudden increase in vacuum causes false grain. To continue with low vacuum would be too expensive to both time and steam consumption with no particular advantage to the grain.

Diesel Locomotives.—A locomotive working on the Diesel principle with crude oil fuel costing 4d. per gallon has recently been turned out by a British firm of locomotive manufacturers, for which it is claimed that it saves 75 per cent. in the cost of fuel over the modern steam locomotive. The Diesel engine is controlled by varying the amount of oil injected at each stroke of the fuel pump, so that the fuel consumption is nearly proportional. to the load. As a result the efficiency of the engine remains practically constant at all loads and speeds. It is started by means of a small auxiliary gasoline engine which works for some two minutes to warm up the main engine.

Java Technical Notes.

Determination of Sugar in Bagasse by Cold Extraction; and a New Figure for Milling Control. **H. Egeter.** *Archief*, 1928, **36**, II, No. 30, 691-729.

Some years back, when chief of the Chemical Division of the J. E. S., Mr. Egeter, in collaboration with Dr. V. Khainovsky, instituted a research into the value of methods of determining sugar in bagasse, as described in Bulletin No. 3 of the Station. This investigation led to the description of a new *cold* method of determining sugar in bagasse, in which a kilogramme sample of unchopped material was used both for the polarization and dry substance determinations. This research also led to a modification of our view of the nature of bagasse, as, based on observations made by Went in 1895, it assumed that bagasse obtained in good milling contained only dead ruptured cells,[1] requiring simply cold extraction to dissolve all the sugar present. Here in brief is the new method of Khainovsky and Egeter[2]:—One kilo. of bagasse (unchopped) is placed in an extracting vessel, and covered with 10 litres of water; after closing by means of the lid, the space above the liquid is evacuated rapidly 15 times, being finally brought to atmospheric pressure, and agitated. But it was found that this cold extraction method gave a polarization somewhat lower than the ordinary cooking procedure, which might be due, either to (1) the solution of dextro-rotary non-sugars in the ordinary hot method, or (2) to the presence in the new method of juice in intact cells, incapable of extraction without heat. That the reason was not due to the first explanation was proved by comparing analyses by the old and new methods of factory bagasse from the 1st, 2nd, 3rd and 4th mills, when it was observed that with the gradual increase of fibre the difference between the two processes decreased (e.g., 9·8 to 6·4, 7·7 to 5·0, 5·4 to 3·7, 4·1 to 2·9), and not increased. Calculated per 100 of fibre, these differences were in one example 11·7, 7·3, 4·5 and 2·9, and in another, 6·6, 4·4, 2·3, and 1·3. This pointed to the presence of unruptured cells in ordinary factory bagasse. On the other hand, bagasse very finely sliced (in a microtome) showed no difference when extracted by cold and by hot water; while heavily hammered bagasse, extracted first by the cold method until the water was negative to alpha-naphthol, and then cooked up with water, gave a liquid which had no polarization. Therefore, it seemed proved that: (*a*) a complete extraction of factory bagasse cannot be obtained by Khainovsky's cold method; (*b*) dextro-rotary non-sugars are not dissolved in the hot method; and (*c*) the differences between the two are due entirely to undiluted juice in unopened cells. Furthermore, it followed that these facts open up the possibility of devising a method of estimating the quantity of juice left in the unruptured cells during milling. Such a method has now, in fact, been worked out by the author and applied in practice, and here are some of the results tabulated:—

	1st Mill	2nd Mill	3rd Mill	4th Mill
Fibre per cent. bagasse	28·10	35·50	40·10	41·45
Brix of the bagasse, total present	12·55	11·01	8·32	7·05
„ „ „ in opened cells	8·06	7·21	5·24	4·67
„ „ „ in unopened cells	4·49	3·80	3·08	2·38
Undiluted juice per cent. fibre, total	228·00	158·00	106·00	87·00
„ „ „ „ in opened cells	146·00	104·00	67·00	57·00
„ „ „ „ in unopened cells	82·00	54·00	39·00	30·00
Volume 100 kg. bagasse, litres	86·30	84·40	83·20	81·50
„ „ „ „ per min.	374·00	290·00	253·00	232·00

[1] *Archief*, 1895, 672. [2] *Mededeelingen Proefstation*, 1927, No. 4.

EXPERIMENTS WITH KROOG AND SWEETLAND FILTERS. **C. Sylmans.** *Archief. Mededeelingen*, 1929, No. 2, 11-55.

Tests were made to obtain an indication of the value of the Sweetland filter, as compared with the Kroog plate-and-frame frame press, as is found in many factories in Java to-day. The Sweetland used was type No. 12, having 48 leaves of a total filtering area of 64·6 sq. metres, while the Kroog had 38 frames, and a surface of 48 sq. m. It was one of a battery of 9 in regular use in the Redjodgoeng sugar factory. A considerable number of runs were made, the results of which are tabulated in this article, filtration and washing curves being given. Advantages found for the Sweetland, as compared with the other were firstly, its greater capacity, which was nearly 27 per cent., using plunger pumps, and 15 per cent. using centrifugals, while other favourable points are as follows : (*a*) Cloth economy, due first to the less filtering area required, and second to fewer breakages ; (*b*) saving in labour, though not to an extent important in Java; (*c*) light work, a point which on the other hand appears of some consideration in that country ; (*d*) less space ; and (*e*) the possibility of increasing the capacity of a battery by shortening the period of discharging. But against these points is to be placed the greater initial cost of the American apparatus. A battery of five Sweetlands of 64·6 sq.m. would cost about 80,000 Dutch florins, exclusive of pumps, and c.i.f. Java ; whereas eight Kroogs of 48 sq. m. would cost about 32,000, that is 4000 each, not counting pumps, and also c.i.f. Another disadvantage noted was the greater amount of sweetening-off water required. Sweetlands were operating in the Goenoengsarie factory, and under the conditions obtaining there, they appeared to be a complete success, eight filters of 64·6 sq. m. dealing with the entire milling capacity of 18,500 quintals or 1850 metric tons of cane in 24 hours, and removing 9·53 per cent. of filter-scum per 100 of cane. This means 167 kg. of dry cake per sq. m. in 24 hours, and only six coolies were required for this battery of filters.

ANALYSIS OF CANE SUGARS. **P. Honig.** *Archief.* 1928, **36**, II, No. 28, 639-647.

Particulars are here given of the latest methods used by the Java Sugar Experiment Station for the analysis of sugars, and these are worth noting by chemists. Polarization, ash, and water content are determined in the usual manner described in most of the books, but reducing sugars have a new procedure. This is to take 33 grms. of the plantation white, 16·5 grms. of the raw, or 8·25 grms. of the molasses sugar, and dissolve these amounts in about 125 c.c. of water in a 150 c.c. calibrated flask, treating this liquid with ½, 1, or 1½ c.c. of neutral lead acetate, making up to the mark, shaking and filtering. Of the filtrate 100 c.c. are placed in a 100/110 c.c. flask, and treated with 1½, 3 and 4½ c.c. respectively of a 10 per cent. solution of sodium phosphate, this liquid being made up to the 110 c.c. mark, mixed, and filtered. Then the reducing sugars in it are determined by SCHOORL's method, which has been described in these columns.[1] As for the *pH* value of the sugar, this is found by dissolving up 20 grms. of the sample in 30 c.c. of neutral distilled water, 10 c.c. of this solution being treated with 10 drops of the appropriate H.I.C. indicator, and compared with a standard buffer solution. Size of grain is determined by a series of TYLER standard sieves, using 50 grms., and weighing the different fractions so as to express their percentage amount.[2]

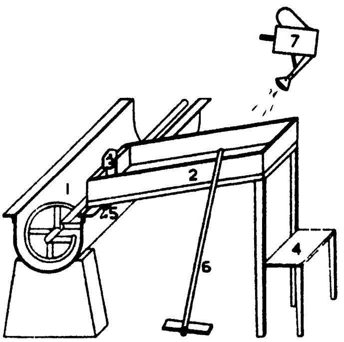
[1] See *I.S.J.*, 1919, 578, 621.

[2] In the sieves mentioned these openings are : above 1 65 mm. (separating the lumps) ; 1·65 to 1·17 (coarse crystals *B*) ; 1·17 to 0·85 (coarse crystals *A*) ; 0·85 to 0·59 (crystals); 0·59 to 0·30 (fine crystals) ; and less than 0·3 mm. (dust).

Colour estimation demands the use of the König-Martens spectrophotometer after carefully filtering the solution and adjusting its reaction to 7·0 *pH*, measurements being made at the following wave-lengths : violet 435, blue-green 509, green 546, yellow 578, orange-yellow 607, and red 725.

WORKING UP LUMPS IN WHITE SUGAR FACTORIES. **W. F. Alewijn.** *Archief*, 1928, **36**, II, No. 28, 657-659.

In every white sugar factory a certain quantity of white conglomerates or aggregates of crystals joined together with evaporated syrup are to be found, the formation of which may be due to the method of handling the steam during curing, or to some other cause. Generally the method of disposing of such material is to crush it and mix it in with the granulated, but this does not improve the appearance of the latter. Moreover, it is found difficult to break up ; while as for re-melting so pure a product this hardly seems good practice. Tests have been carried out by the Java S.E.S. for the purpose of ascertaining the best way of dealing with these lumps, a means being found of doing this which involves the remelting of a small proportion only. This was done by means of an apparatus on the lines of the sketch, the process being first to separate by means of a coarse sieve any dust, this being later dissolved in the clarified juice ; then to moisten the lumps with as small a quantity of cold water as possible in the box 2, so as to loosen the individual crystals, thus permitting the worker later to send them into the conveyor 1, from whence they are transferred to the after-workers of the centrifugal battery.



Beet Factory Technical Notes.

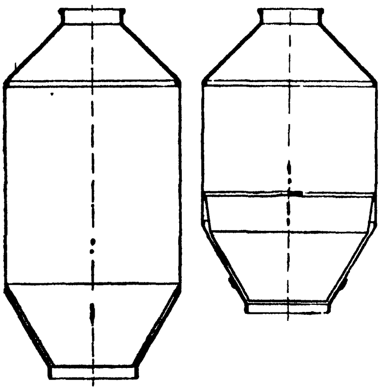
Oxford Process.—At one of the recent meetings of the Saxony branch of the Association of German Sugar Technologists,[1] the Oxford process was strongly criticized by Dr. O. SPENGLER, Director of the German Institute for the Sugar Industry, Berlin, whose authority and impartiality one can hardly question. He first discussed the existing literature of the subject, emphasizing that none of it had any scientific value, the pamphlet by Dr. CHAMIER, for example. He informed the meeting of proposals he had received from different sides that, as Director of the Institute for the Sugar Industry, he should examine the Oxford process, but these so far had not come to anything. Arrangements made by the Institute for so doing had been countermanded on the English side at the last moment for more or less transparent reasons. At any rate, a thorough scientific examination according to German methods and with German chemists as had been proposed by the Institute as a necessary first condition seems to have been regarded with some antipathy.

Next Dr. SPENGLER pointed out that the idea of the process was an old one, and he gave some details of an article published in the Journal of the Association[2] on experiments made in the year 1837 in the Waghäusel s. f., which had had no great success. This process had been taken up by DE

[1] *Centralblatt fur die Zuckerindustrie*, 1929, **37**, No. 13, 368. [2] *Vereins-Zeitschrift.*

VECCHIS, and modified without having been essentially altered. The costs of drying must be enormous, as one must work slowly, and at a low temperature. Further the percentage of molasses produced must be very high, as the juice is treated with only a little lime and some superphosphate. Nor in the Oxford process of Prof. OWEN had the lecturer been able to discover anything new, excepting the declaration of the English inventor that he utilizes exothermic processes. But just as in the heating up of a heap of hay a diminution of its value results, so also is this in the case of beet, but at the expense of the sugar. If before and after drying the invert sugar is determined, and the same amount found both times, this proves nothing, since part of the sugar has been completely destroyed. Experiments made with the greatest care in the Institute concerning this had shown a loss of about 1 per cent. Moreover, the cost of drying must not be underestimated. In the *Transactions of the Institution of Chemical Engineers*, Prof. OWEN himself had admitted that he reckoned 8 per cent. of coal on the fresh roots. From the above, then, it would seem that the German experts profess to remain sceptical as to the Oxford process having touched any new ground or achieved any definite measure of success.

Improved Diffusers.—It is recognized that in times further removed than the present, when diffusion vessels were of smaller content, complaints regarding bad pressure were not so frequent. To-day large diffusers having openings as wide as possible are the vogue. This may be so ; but the writer of an article[1] points out that with a certain slice space there should be an optimum sieve surface. In comparing two diffusers having the same diameter, but discharge openings of different sizes one observes that the wider the opening of the under-cone, the smaller will be the surface of the sieve. Experiments have shown that the capacity of a diffusion battery can be improved by increasing the sieve surface of the individual vessels. In fact by concentrating in this direction surprisingly good results are obtained in respect of increased beet tonnage, diminished juice draw-off, and lower pulp exhaustion.

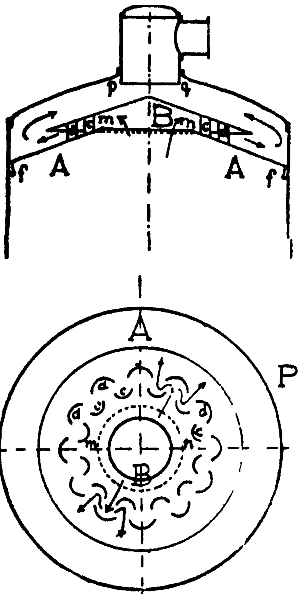


No. 1. No. 2.

In the illustration No. 1 shows a diffuser of the old high construction, having a diameter of 1850 mm., and a content of 80 hl., its sieve surface (cone and cover together) amounting to 4·4 sq. m., which gives the ratio between content and surface as 1 : 18·2. On the other hand, No. 2 depicts a vessel of 60 hl. content, having a much greater sieve surface (obtained in the manner indicated in the drawing), viz., 6 sq. m., this corresponding to a ratio of 1 : 10. Even if the 80 hl. content were maintained, this would give an improved ratio, viz., 1 : 13·3. It is stated that diffusers having this type of increased sieve surface have proved very satisfactory in a number of factories in Germany, and that well-exhausted slices are obtained with low draughts. Complaints as to bad pressures are now seldom heard, even with inferior slices. Stoppages are no longer experienced, it is said, with this type of diffuser.

1 *Centr. Zuckerind.*, 1929, 37, No. 11, 310-311.

Evaporation Losses.—In regular beet factory operation undetermined losses amount to about 0·5 per cent., of which about 0·3 per cent. is estimated to be due to entrainment, that is to the juice or syrup being carried over with the spray into the condensed water. HODEK's sieve " save-all " has largely limited this loss. But according to E. PSENICKA, of Beroun, in Czecho-slovakia,[1] loss of sugar in evaporation can also occur in another way. He has observed that the syrup thrown against the walls of the vessel during boiling gradually creeps up until it reaches the neck of the dome where, owing to the immense velocity of the vapour, it is suddenly blown over into the condensed water in the next body or into the barometric condenser.



He now describes an apparatus invented (and patented) by him, which arrests both actions. It consists of two superimposed deflectors; the lower conical one *A* concentrates the vapour against the upper one *B*, which directs it against the semi-circular baffles, *c*, *d*. These suddenly change its direction, and cause the separation of the entrained juice, which falls back through *f*, *f*, into the boiling liquid. Regarding the second action, any of the syrup which has crept up the walls of the evaporator is arrested by the protecting rim, *p*, *q*, in the neck of the dome, causing it to fall upon *B*, and thence through the openings *f*, *f*, into the boiling liquid again.

American Improvements.—Factories of the Great Western Sugar Co. have recently added to their equipment. Longmont now has a drum filter installation (bringing her into line with seven of the ten STEFFEN plants) this comprising seven Oliver drum filters, 8 ft. dia., and 14 ft. long. Nine men will do the work formerly requiring thirty and a saving of approximately 85 per cent. in filter-cloth per ton of molasses is estimated. It should now be possible to obtain higher purity of saccharate milk resulting in better working syrups. Sterling, lacking ability to increase power capacity, now becomes a complete alternating current house. From each of Brighton and Mitchell, respectively, Sterling will receive an 825 KVA generator directly connected to a 28 by 42 in. Corliss engine.

The " group drive " system will be used, which means that several pieces of equipment are operated by a single motor. This method aims at realizing a high power factor with minimum installation cost. Elimination of direct current at Sterling marks a tendency in Great Western Co. operating economy. Other alternating current mills now include Brush, Mitchell, Minatare, Ovid, Lyman, Billings and Fort Morgan. Brighton and Mitchell each will receive a 1250 KVA Allis-Chambers turbo-generator, not essentially unlike the machine at Johnstown. With but half the floor space, these machines will give Brighton and Mitchell approximately 50 per cent. more electrical capacity. Where the former Corliss engines operated at around 120 revolutions per minute, the turbo-generators whirl at 3600, with a saving of possibly 75 per cent. in lubricating oil. The hot saccharate installations at

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, No. 22, 273-275.

Ovid and Minatare will, at each factory, include a heater, Dorr thickener, two drum filters and centrifugals and vacuum pumps.

De-Liming Juices.—Discussions have been going on in the German technical press on the value or otherwise of boiling the second carbonatated juice with the object of inducing the precipitation of its excess lime content. Dr. B. BRUKNER and his colleague, TH. BREITHAUPT, of the Kleinwanzleben s.f.,[1] took a series of samples of clarified juices from the gutters of the 2nd presses, and observed their true alkalinities before and after boiling for 5 min. In every case excepting one, the alkalinity (denoting CaO per cent.) increased, and in that one case it remained constant and did not decrease. Next a sample was taken from the first presses, carbonatated to an acidity of 0·020 per cent., and the following two experiments made with it: (1) filtered, boiled for 5 min., and again filtered: alkalinity, 0·012 CaO per cent., and lime content, 0·0256 per cent.; (2) boiled for 5 min. without being filtered: alkalinity, 0·012 per cent. CaO, as before, but lime content, 0·0094 per cent.

That is to say, 9° (German) of hardness without filtration compared with 25° when the "seed" was previously separated by filtration. Further tests were made to ascertain whether in practice boiling would really be necessary to effect a reduction of the lime. Juice from the first presses heated by immersion in a hot-water bath was carbonatated with lime kiln gases (containing 37 per cent. of CO_2) to a point at which the alkalinity no longer diminished after quarter-of-an-hour. Using a temperature of 70°C. in the water-bath, the lime content after the experiment was 0·0156 per cent., but at 90°C., it was only 0·0088 per cent. The advice of the writers is to heat up the juice before running it into the carbonatation tanks, and carbonate off nearly at boiling point, using an excess of CO_2 to saturate to about neutral point. An excess is not harmful, it is said, as only traces of bicarbonates can form in the hot juice. Therefore, they conclude, to obtain a low lime content do not boil up the juices, but carbonate them hot.

Filter-press Cloths.—Dr. K. SANDERA,[2] well-known chemist at the Sugar Experiment Station, Prague, has collected a good number of data from 64 factories regarding filter-cloth, and the information he summarizes is worth attention to those concerned with economy in this direction. Estimated on a basis of 1000 dz. (100 metric tons) of roots, the total filtering area used is from 27·2 to 68·6 sq. metres. Replies received in regard to the frequency of re-dressing presses showed this to vary considerably, namely from 4 to 40 days; the life of the cloths is put down as from 10 to 80 days, and their cost (still on the basis of 100 tons) from 51 to 230 Czecho-slovakian crowns. In 25 per cent. of the factories the cloths were changed after 6 to 7 days; in 30 per cent. after 8 to 14 days; in 18 per cent. after 15 to 21 days, and in 17 per cent. after more than 22 days.

The reason generally ascribed for the changing of the cloths was indicated as the slowing-down of filtration; while tearing, hardening, and impermeability were given as further grounds for their renewal. Clogging of the pores of the cloths is stated to be due to improper carbonatation, to the use of wrong juice temperatures, to errors in diffusion, or to washing too frequently. Most factories leave the cloths in the presses as long as is possible. Jute cloths last 10 to 14 days, and cotton up to 80 days. As to the material used, 54 per cent. use cotton cloths, 31 per cent. a mixture of this fibre with jute, and 15 per cent. linen and jute. Most factories prefer cloths having the strengthened edge.

1 *Die deutsche Zuckerindustrie*, 1928, 53, No. 45, 1278.
2 *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 53, No. 27, 321-329.

The Sugar Industry in the British West Indies.

Department of Overseas Trade Report for 1926 and 1927.

From a recently issued Department of Overseas Trade Report on "The Economic and Financial Conditions in the British West Indies as at November 30th, 1928," as prepared by H.M. Trade Commissioner's Office at Trinidad, we take the particulars set out below of the sugar industry in the various islands. In some cases what follows is reproduced in abridged form.

Jamaica.

Sugar continues to improve and the exports for 1927 stood at just under 50,000 tons valued at £800,000. An even larger crop was to be expected for 1928, for the favourable seasons combined with a higher standard of tilling on the larger areas of sugar cane have produced the highest tonnage of canes grown in Jamaica for the past half-century. The substitution of some of the new canes introduced by the Department of Agriculture for the standard estate cane has greatly improved the yield of sugar on many fields and a rapid extension of new cane is now taking place.

The problem of rum remains one of grave difficulty. Estates are seeking to reduce the production of rum by every means, and some are even using molasses as manure for the cane-fields, a proceeding hitherto unknown in this Colony, which had always been able to find a profitable use for molasses in the manufacture of rum. Local consumption increases to some extent. The quantity of rum exported, however, though greater than in 1926, fell short of the 1925 quantity, as the following figures will indicate: 1925—1,121,332 gallons; 1926—693,435 gallons; and 1927—740,528 gallons.

Trinidad.

The production of sugar has shown a tendency to increase in recent years, and a certain amount of land formerly under cocoa has been converted to this crop. The 1926 crop was a record one, 73,561 tons, and would have been considerably larger, due to the increase in area under cane and to the improvement of cultural operations on the estates had it not been for the attacks of froghopper, the severe dry season providing very favourable conditions for this pest which did great damage. In 1927 the weather conditions minimized froghopper attacks and a crop at least equal to that of 1926 might have resulted. Unfortunately these same conditions made reaping and transport so difficult that over 70,000 tons of cane had to be left uncut; they also caused the sucrose content to be abnormally low in the canes which were harvested. The result was that the production fell to 51,982 tons. 1928 figures are, however, expected to redress the balance as total exports for the eleven months ended 30th November, 1928, amount to 74,000 tons and constitute a record.

Labour conditions are not so satisfactory at present as formerly, and it is likely that greater use will be made of machinery. It must not be overlooked, however, in estimating the value of the market for estates equipment as distinct from factory machinery that by no means the whole crop, which approximates to 750,000 tons of cane per annum in a favourable year, is grown by the large estates. Almost half the production is by peasant farmers who cannot be considered as likely buyers of other than the simplest plantation tools. There is, however, increased scope for the sale of cane trucks, mechanical tractors and light railway equipment. The greater part of this trade was formerly in the hands of the United States. Power ploughs of United Kingdom manufacture are now being bought, and it is reasonable to expect that Great Britain will receive an increasing share of the trade in future.

The quantities and values of exports for the last three years have been :—

	1925. Tons	£	1926. Tons	£	1927. Tons	£
Grey crystals ..	30,913..	454,396..	57,626..	871,156..	28,315..	514,946
White crystals ..	2..	80..	3..	54..	3..	58
Yellow crystals..	25,751..	567,192..	6,138..	235,840..	12,814..	235,840
Molasses crystals	2,886..	51,750..	1,411..	17,872..	570..	9,972
Muscovado sugar.	747..	11,786..	502..	6,960..	162..	1,548
Refined	349..	7,307..	250 lb...	2..	— ..	—
	Gallons		Gallons		Gallons	
Molasses........	1,271,050..	29,639..	1,427,274..	14,330..	1,188,840..	14,471
Rum	28,474..	5,319..	71,213..	10,933..	35,699..	8,155
Bitters	58,336..	75,734..	56,599..	80,915..	55,152..	79,570

BARBADOS.

According to the Customs returns, the following are the figures of export of sugar and molasses during 1926 and 1927.

	1926.		1927.
Sugar.	Tons		Tons
Dark crystals	42,990	..	50,220
Muscovado	2,795	..	2,885
	45,785	..	53,105
Molasses.	Gallons		Gallons
Fancy.....	7,085,523	..	7,294,202
Choice	431,608	..	501,640
Vacuum Pan	243,203	..	462,848
	7,760,334	..	8,258,690

The total value of the 1926 exports was £904,564, and that of 1927 £1,242,335. The average price for dark crystal sugar was $2·75 per 100 lbs. in 1926 and $3·27 in 1927.

During 1926—305,528 gallons of rum were manufactured in Barbados, of which 223,701 gallons were consumed locally ; in 1927 the figures were 269,328 and 246,680 gallons respectively.

There was an abnormally large rainfall during the reaping season in 1927 ; these conditions, following upon the moderately good year of 1926, produced a sugar crop of high tonnage but low sugar content. The result was that the total sugar crop amounted during 1927 to 72,301 tons, the largest since 1916.

BRITISH GUIANA.

The sugar crop of this Colony for 1926 was 98,152 tons as compared with 99,548 tons, the average yield of the preceding ten years. In 1927 the total area reaped was 56,534 acres, yielding 114,030 tons, of which 109,616 tons was exported. This quantity exceeded that which was shipped in any year since the termination of the war, and was, with the exception of the exports for 1915 and 1917 (when 116,223 and 114,006 tons respectively were shipped), the largest shipment since the financial year 1908-1909.

Rum production amounted to 1,436,010 gallons, of which 1,081,120 gallons was exported. Exports of molasses amounted to 2,677,457 gallons. Twenty-seven per cent. more rum was exported during 1927 than in the previous trade year, and the quantity of molasses shipped was the largest that has ever been exported from the Colony in any one year.

The 1928 production is estimated at 109,303 tons. The effects of the drought during the latter part of 1925 and the beginning of 1926 make comparison between 1926 and 1927 useless. Comparison between 1925 and 1927, however, shows that the area reaped in the latter year was greater by 1622 acres, but output increased by only 1937 tons, from which it would appear that the average yield was greater in 1927 but not general throughout the Colony. Exports of sugar to 30th June, 1928, amounted to 55,696 tons.

St. Lucia.

The production of sugar for 1926 was somewhat lower than for the previous year but was still an advance on the output for 1924; low prices prevailed during the crop period but improved towards the end of the year. There was a better market for molasses and syrup.

In 1927 work was maintained with energy on three of the four sugar factories in the island, and under new management considerable development took place at the Roseau factory, which is situated in one of the most fertile valleys in the island. The area under cultivation remained at about 4750 acres; unfavourable weather conditions prevailed throughout the reaping season and rendered harvesting difficult and prolonged, and the yield of sugar was low. One factory did not complete the harvesting of the crop, consequently the output of sugar products was generally lower than that of the previous year. Market prices were more favourable, however, and the value of the products showed an increase. The quantity of vacuum pan sugar turned out in 1926 was 4757 tons and in 1927—4432 tons; of muscovado, in 1926—457 tons and in 1927—180 tons. The quantity of rum produced was small, and is practically all consumed locally.

Antigua.

Following on a disappointing year in 1926, 1927 was a most favourable year. The output of sugar was the largest since the central factories were erected, and amounted to 23,195 tons. Of this the Antigua Sugar Factory, Ltd., produced 19,795 tons at 9·2 tons of cane per ton of sugar and the South Western Estates Co., Ltd. (Bendals Factory) 3400 tons. The price of sugar too was more satisfactory than in the previous year, averaging £16. 6s. 3d. per ton, as compared with £13. 14s. 11d. in 1926. Very little muscovado was produced during 1927, only one factory operating, the sugar from which was consumed locally. The quantities of molasses and fancy syrup exported for the period in question were:—Vacuum pan molasses, 715,377 gallons; muscovado and fancy syrup, 36,454 gallons.

British Honduras.

Normal production of cane sugar in British Honduras is about 2000 tons a year, a quantity insufficient to meet local requirements. This factor in conjunction with the new steamship service to Canada and the preference given by the Dominion are encouraging features of the prospects of the sugar industry in this Colony. At present the area under cultivation is limited and the factories small

India.—A Report of the Department of Overseas Trade states that there is a most encouraging increase in the imports of British sugar machinery into India from Rs. 2½ lakhs to 16 lakhs, largely due to energetic representation on the spot.

Trinidad's 1928 Sugar Production.—The production of raw sugar in Trinidad in 1928 reached the record figure of 81,551 tons, or 8000 tons above the previous record achieved in 1926. Unfortunately the price received for the sugar was much less satisfactory than in the preceding season.

Brevities.

Petree & Dorr Patents.—We are requested to state that Petree & Dorr Engineers, Inc. of New York, have entered a suit against the Southdown Plantation of Louisiana, for the alleged infringement of their patents by the use of the Ruckstuhl apparatus installed there.

Motor Driven Locomotive Cranes.—The American Hoist & Derrick Company are making a specialty of three-speed gasoline-driven locomotive cranes specially designed for efficient gasoline operation. In these flexibility equal to that of a steam crane is claimed to be obtained through the use of a three-speed gear-box.

Beet Dehydration.—This process is being tested in Russia. At Derjugino factory, for example, a Scott Dryer has been installed under the personal supervision of De Vecchis, its capacity being 120 tons daily.[1] Elsewhere the Pancyrew and Schumilow dryers are being examined, the first of these being a band and the second a so-called surface dryer.

Louisiana's 1929 Acreage.—A statement issued by Dr. Arthur Rosenfeld, Technologist of the American Sugar Cane Leauge, reports a total cane area in the Louisiana cane belt this season of 225,000 acres, as compared with 170,000 acres last season. This indicates a potential production of some 250,000 tons of sugar on the basis of the splendid stand of cane now in evidence, but is of course subject to favourable growing and harvesting weather.

Vallez Filter.—C. Sylmans in his paper on the results of tests obtained with Sweetland and Kroog filters[2] (abstracted elsewhere), also gave some particulars of the operation of the Vallez filter in the Poerwodadie s. f., Java. The total filtering surface was 50 sq. metres ; the pressure 1·5 to 2·8 atmos. ; time of filtration, 45 min. ; and the total filtrate per sq. metre of filtering surface 4·3 to 4·9 hectolitres. Of the three types of filter, the Vallez is regarded as having given the best results generally.

Fertilizers.—In America, attention is being given to concentrated fertilizer materials, especially salts in which both the acid and basic radicals contain essential elements, ammonium phosphates for example. W. H. Ross, A. R. Merz, and K. D. Jacob[3] describe methods for the technical preparation of mono-ammonium phosphate and di-ammonium phosphate. They also outline their properties, stating that such salts give promise of extensive utilization as commercial concentrated fertilizers.

Mauritius New Crop Sugars.—According to Golodetz's Market Report, a beginning was made at the end of April of sales of 1929 Mauritius raws to the United Kingdom. Several cargoes for August to October shipment were done to U.K. refiners at 13s. 11¼d. c i.f., which is the equivalent of about 9s. 6d. basis full duty sugars. The total sales of the Mauritius Syndicate to local exporters since the marketing of the new crop began in mid April were at the end of that month some 50,000 tons raws and 2500 tons of whites.

Sucrose.—W. D. Helderman, two years ago, obtained some physical constants which seemed to show that a second modification of sucrose exists having a different density and heat of solution than ordinary sugar.[4] Now, however, the distinguished Swiss chemist, Prof. Pictet, and his assistant H. Vogel,[5] on examining these claims, bring evidence to show that the so-called second modification does not exist, and that there is complete uniformity in respect of constitution and configuration between sucrose as crystallized by Helderman and that generally known.

Constant Temperature Valve.—A valve has recently been put on the market which is claimed to be the only automatic temperature regulator, suitable for any service, capable of maintaining a constant temperature within 1°F. The automatic control of the steam supply is operated electrically, the apparatus consisting of three principal parts, the valve itself, a thermometer, and a transformer. These may be fixed in any suitable location, connected by wires any distance apart. This apparatus has already found use in jam factories, breweries, dyeworks, chemical factories, and other manufactories extensively.

[1] *Centr. Zuckerind.*, 1929, 37, No. 2, 42. [2] *Archief, Mededeelingen*, 1929, No. 2, 11-55. [3] *Ind. Eng. Chem.*, 1929, 21, No. 3, 286. [4] *I.S.J.*, 1927, 683. [5] *Helvetica chim. acta*, 1928, 5, 901 ; through *Centr. Zuckerind.*, 1928, 36, No. 49, 1362.

Brevities.

Peruvian Exports of Sugar.—The exports of sugar from Peru for the year 1928 are reliably put at 311,312 metric tons, as compared with 297,864 tons in 1927, and 328,698 tons in 1926. Of this 1928 quantity 130,565 tons went to Chile, and 121,255 tons to the United Kingdom.

Coloured Sugar :—" Dapple sugar," better named " Harlequin sugar," has made its appearance on tea-tables in the United Kingdom. This consists of large crystals which are multi-coloured (yellow, blue, green and white), selling at as high a price as 1s. per lb. These coloured coffee crystals, which certainly are an attractive novelty, can also be bought in single colours to match the afternoon tea-table colour-scheme.

Filter-Cloths.—Among the causes which lead to the damaging of cloths as used in filter-presses are the following : rust on the edges of the filter-press frames ; carelessness in dressing leading to unnecessary strains ; cloths remaining too long in the frames ; addition of soda to juices or wash-waters ; and washing the cloths with dilute acid, or in machines which injure them. A cloth has recently been put on the market which possesses a border of double strength, and this is stated much to reduce cloth consumption. The cost of filter-cloths per ton of roots in Holland is said to amount to 2·1 to 6·5 Dutch cents.[2]

Carbonatation Process.—In Java it has not been found possible to apply hydrogen-ion control to first carbonatation juice;[3] but very satisfactory results are obtained in the second carbonatation, which must be carried to 8·6 to 8·1 *pH*, at which limit over-carbonatation is avoided. The filtered juice is later sulphured, after which a thick-juice (syrup) is obtained, which need not be sulphured. Although the *pH* of the second carbonatation juice may be held at the limit stated throughout the season, the calcium content of the filtered juice gradually falls (e.g., from 240 to 170 mgrms. CaO per litre), the reason for which is not clear.

Seed Cane.—In Queensland[4] seed cane was soaked previous to planting in certain solutions, and the effect observed on germination, tons of cane per acre, and tons of sugar per acre. Soaking in saturated lime-water containing 1 lb. of magnesium sulphate (Epsom salts) per 50 gallons of water for 48 hours gave the best results in this respect, the three figures mentioned being 97, 42·2 and 6·46 ; whereas without treatment they were 88, 35·6 and 5·61. Similarly good results have been obtained at each of the Experiment Stations in Queensland, and it is concluded that there is no doubt at all as to the benefits to be obtained from this treatment.

Sugar Expansion in Philippines.—According to a D.O.T. Report there are 35 sugar centrals now in operation in the Philippines with others building or contemplated. There are hopes and plans of extending the sugar industry considerably, but, as the Report remarks, the position in the United States (which takes some 90 per cent. of the Philippine sugar export) is the cause of considerable concern to the sugar interests of the Islands. There is as is well known much opposition in America to the indefinite expansion of free importation of Philippine sugar, and proposals have been made for legislation in Washington to limit the amount of such import ; any such restriction would be disastrous to hopes of expansion, and may even imperil the present standing, of the sugar industry of the Islands which is so largely dependent on the open United States market.

Dr. Vladimir Stanek.—This eminent Director of the Sugar Experiment Station, Prague, recently reached his 50th birthday, on which day, the 1st of April, the 30th anniversary of the Institute which he controls so ably was also celebrated. Dr. Stanek is an investigator of the first rank, and the high standard of the work he has carried out has greatly assisted in establishing the high reputation of the Prague station. A brochure attractively printed and illustrated (" Stanek's Heft ") is published on the occasion of this jubilee, and contains a statement by Mr. H. Cron, President of the Association of Sugar Manufacturers of Czecho-Slovakia, recording the great services which have been rendered by Dr. Stanek to the sugar industry of that country. It also contains a number of interesting articles by some of his colleagues, which later will be noticed in these columns.

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1928, 53, (Rundschau).
[2] Caals : *Tijdschrift*, 1928-29, No. 7. [3] W. Thomson : *Archief*, 1928, 36, 1201-1219.
[4] *Annual Report of the Bureau of Sugar Experiment Stations, Queensland*, 1928.

Review of Current Technical Literature.[1]

QUESTIONNAIRE ON CRUSHING PLANTS IN THE PHILIPPINE ISLANDS. **Theo. Nickelsen.** *Committee Reports for the Sixth Annual Convention vf the Philippine Sugar Association*, 1928.

Mr. NICKELSEN, Chairman of the Committee on Manufacturing Machinery of the P.S.A. circulated among his friends a very complete questionnaire designed to cover the entire range of operations in the factory, the purpose being to elicit useful practical information from members of the Association on matters to which some have given special study. Mr. NICKELSEN himself returns some very interesting replies, our summary of which is now continued.[2]

Q. Is there any point in erection or operation of a crushing plant including engines, gearing, roller design and structure, bars, scrapers, juice rings, carriers, preparation units, unloaders, intermediate conveyors, cush-cush strainers, juice flumes, troughs and pumps, that you might advance and give to us for dissemination for the general good of our industry ? If so, what are these and please specify your suggestions. *A*. In the natural progress of industrial manufacture the experience of the engineers, and others in the factory, plus that of the designing engineer of the machinery manufacturer will, in the course of events, make those improvements that tend to assist in building up the efficiency of our equipment. The smaller moving parts of a mill, year by year, are being replaced by other methods of drive when these, as such, are found inefficient and wasteful in time and money. The scheme for pumping the total volume of mixed unstrained juices from the mills without the necessity of the present complicated juice strainer is finding favour with some engineers ; and, although not fully developed at present, this, or some other method equally simple, may do away with the cumbersome, mechanically operated, cush-cush elevators, or juice strainers, in operation at the present time. Intermediate conveyors with their high maintenance charges and causes of costly stops also will, no doubt, be superseded by some other method of conveying the crushed cane from mill to mill, that takes less power and material. Transmission gearing with its heavy power losses will also be a thing of the past in the new mills ; and reduction gearing, of highest workmanship, minimum loss of power, maximum ease in operation, together with lower costs and less time losses will be seen to supersede the heavy old fashioned gearing now used on all mills in the Philippines. *Q*. What is your opinion on the revolving knife question ? *A*. The superior design of knivos, found on the markets to-day, with electric motor direct drives, are very necessary to the work of the latter day cane milling units. A set of knives of conventional design such as Hind-Ogg, Simpson or Mirrleos Watson, will amply repay, provided driven with adequately powered motors or engines and located so that the ultimate of the inherent efficiency of the knives is utilized. *Q*. Are you in favour of water-tube or smoke-tube boilers of the H.T. type for sugar factory work ? *A*. Water-tube type, because of their flexibility, saving of space, safety, and less incrustation when using impure waters ; and because they are not so liable to priming and foaming and are more easily repaired when damaged through incompetent operation. *Q*. What would be your idea of an ideal setting for boilers ? *A*. An ideal setting for a water-tube boiler would be such that : the maximum amount of bagasse can be burned at highest efficiency ; the cleaning of ashes can be made whilst the boiler is in operation ; the burned gases are allowed to escape in a straight line to the stack ; the baffling of the gases among the tubes is made without forming pockets for the accumulation of ashes ; the combustion chamber is at least 15 per cent. greater than is the theoretical requirement ; the furnace grates are flat, and suspended, flat arches superseding the present circular type arch ; a special discharge of the bagasse from the hopper to the grates is made that will spread the fuel evenly over the total grate surface ; the flat arch, and deflecting arches, for mixing, are not less than 8 to 10 ft. in height, measured from the grate surface ; the bridge wall has an overhang to insure a thorough mixing of the gases of combustion. And a draft of at least $\frac{7}{8}$ in. measured at the base of stack, under normal working conditions. For fire-tube boilers is recommended the

 2 For the preceding summary, see *I.S.J.*, 1929, 219.

Dutch oven type with flat grates and ample combustion chamber of proportion at least 2·5 cu. ft. to 1 h.p. and passages of large area so that the volume of the gases may not be restricted in its passage over the surface of the boiler shell and through the flues. The design of furnace and chambers must be such that total combustion of the gases takes place before they impinge on the comparatively cold shell of the boiler. Space at the back of the bridge wall should be made to hold a week's residue of ashes, this pit to be of sufficient depth to insure against the liability of the ashes being carried up into the tubes. A soot blower arrangement for cleaning the flues, whilst the boiler is in operation, is essential to the equipment here. The gases should have straight line exits to the stack. The area of the passage ways over the bridge wall should not be less than 15 sq. inches to 1 h.p. of boiler rating. *Q*. Are you an advocate of the flat grates ? *A*. The flat grate is the most desirable because it burns the fuel at the greatest distance from the top arch and therefore has a freer mixing range for the gases of combustion and is more easily controlled. The burning of the bagasse on the top steps of a step ladder set is conducive to choking and incomplete combustion of a part of the fuel. The fuel, at the lower levels, it may be noticed, in a furnace equipped with step grates, burns much brighter than the upper layers which tend to smolder and smoke, thus causing a loss through releasing CO in place of CO_2 in the products of combustion. *Q*. Do you believe that our bagasse burning boilers are up to the limit of efficiency in operation ? *A*. No, balanced draft with air or water cooled furnace walls and automatic stokers will displace ultimately the present inefficient furnaces for burning bagasse under boilers. Our furnaces fall short in methods of operation, furnace volumes, specific grate areas, methods of distributing the bagasse therein, combustion volumes and drafts. *Q*. Have you any suggestions on the use of the different condensate waters used in your boiler feed ? *A*. These waters should be under the supervision of the Chemist and samples taken hourly. The piping should be so arranged, in its discharge to the hot well, that all waters are separated in their several pipes, and these in turn, should be equipped with valves and by-passes to enable the individual waters to be diverted into the waste ditches, when these are found to be contaminated. Small amounts of soda continuously fed to the boiler feed pump, with a system of surface, and mud drum blow off each twelve-hour watch, will help to keep the boilers free from sediment. Boilers supplying steam to the power lines should be equipped with superheaters and tracifyers to arrest the suspended foreign matter in the steam in order to protect the turbines, etc. *Q*. Which do you prefer, duplex piston type, or centrifugal water feed pumps ? Please give reason for your preference. *A*. Centrifugal type with heavy duplex piston type for stand by and fire fighting uses. As a point in favour of the centrifugal feed water pump, it is to be remembered that the closing of all valves on the discharge line does not generally result in broken connexions, whereas this may result so on a line discharge, unprotected, when operating a piston type of pump. Also, a two, or three stage, centrifugal pump of latest design is reliable and its upkeep and maintenance, in the absence of numerous valves, plates and springs, is a recommendation.

— — — —

Utilization of Bagasse for the Manufacture of Artificial Silk. *Bulletin of the Imperial Institute*, 1929, **27**, No. 1, 1-6.

At the present time the bulk of the cellulose employed in the manufacture of artificial silk by the viscose process is derived from chemical wood-pulp prepared from spruce wood. In view of the rapid expansion of the artificial silk industry, it is obviously desirable that consideration should be given to the possibility of increasing the range of materials available for the manufacture. From this point of view attention has been devoted in recent years in different countries to a consideration of various local woods and fibres, and to by-products, such as bagasse, in order to determine their suitability as sources of cellulose for artificial silk. The bagasse used was from Trinidad, and consisted of fibrous chips and crushed cane in pieces of irregular size up to 5 in. in length. A large quantity of pithy matter was present, adhering to the fibrous material. A chemical analysis carried out on the bagasse as received, without any separation of the pithy matter, gave the following results :—Moisture 10·8 per cent., ash 1·2 per cent. cellulose in material as received

51·2 per cent., cellulose expressed on the moisture-free fibre, 57·4 per cent. Owing to the presence in the material of the pithy matter, which would be unsuitable for use in the preparation of cellulose intended for the manufacture of artificial silk, the material was subjected to mechanical treatment with a view to its separation before digestion; the fibrous material was then treated with caustic soda under conditions similar to those employed commercially for the production of pulp. The conditions of this digestion were sufficient to yield a well reduced pulp which bleached fairly readily to a cream colour. The cellulose obtained was examined chemically as to its suitability for the manufacture of artificial silk, and was found to contain 5·1 per cent. of moisture and 0·22 per cent. of ash and 78·75 per cent. of α-cellulose, calculated on the moisture-free material. The pulp was thus deficient in α-cellulose, showing that the original material required further purification. A further quantity of the bagasse was therefore taken and treated as follows :—(1) The air-dried material was freed as far as possible from pith by rubbing and sieving. (2) The material was submitted to a preliminary process of fractional digestion as follows :—(*a*) Boiled with water with continous agitation, then filtered through a coarse sieve. This operation was repeated. This removed starches, sugars, soluble gums and other water-soluble matter, together with some more finely-divided pith. (*b*) Boiled with 1 per cent. caustic soda. The pithy matter attached to fibres swelled and could be fairly readily separated by agitation. This operation was repeated, and removed resins, fats, waxes, etc., together with pectose. (*c*) A further washing in water was given and the material finally freed from almost the whole of the remainder of the pith by a light beating treatment in the Hollander. The material thus obtained after air-drying contained 6·5 per cent. of moisture, which was approximately the same as the amount present in the original material. This material, constituting 40 per cent. of the original untreated bagasse, was digested for 3 hours at 140°C. with caustic soda (20 parts per 100 parts of material or three parts per 100 parts of solution). The pulp, which was fairly long-fibred, bleached readily to a pale cream and when dry could be fairly easily disintegrated by hand, the yield of dry bleached pulp on the air-dry original material being approximately 24 per cent. On examination as to its suitability for the manufacture of artificial silk, the pulp gave the following figures, which are shown in comparison with (*a*) those recorded for bleached suphite pulp of quality suitable for this purpose, (*b*) figures supplied by a manufacturing firm for pulp regularly used by them and (*c*) figures recorded for commercial absorbent cotton :—

	Present sample of Bagasse	Figures recorded for bleached sulphite pulp of satisfactory quality (1)	(2)	Figures for wood pulp	Figures for absorbent cotton
Moisture per cent.	7·70	8 to 12	10	—	4·34
Ash per cent.	0·14	1·15 to 0·3	0·1 to 0·4	0·17	0·11
α-Cellulose per cent	86·10	85 to 89	86 to 89	89·63	87·60
β-Cellulose per cent.	12·60	—	6 to 8	3·69	12·20
γ-Cellulose per cent.	1·30	—	3 to 5	6·63	0·12
Copper number	0·56	Not over 3	2 to 3	2·47	1·13
Phloroglucinol absorption value per cent.	1·19	—	—	1·03	—
Soda absorption value	215	—	—	162	—
Acetone extract per cent.	0·26	0·6 to 0·7	—	—	—

These figures indicate that the bagasse pulp prepared in the second experiment would be quite suitable for the manufacture of artificial silk. The amount of α-cellulose present is slightly above the minimum usually present in bleached sulphite pulp used for artificial silk production. Moreover the quality of the pulp as shown by its copper number, phloroglucinol absorption value, and acetone extract, is very satisfactory, these values being all very low. It will be observed that the bagasse

pulp contained a rather large amount of β-cellulose, and in this respect resembled cotton rather than sulphite wood pulp. The behaviour of the pulp would, however, have to be determined by manufacturing trials before a definite pronouncement could be made as to its suitability for the purpose. The purification process would probably offer little difficulty in the factory, with the employment of suitable mechanical agitators by means of which an even better separation of the pithy matter might be secured, and, as a result, pulp obtained with a still higher α-cellulose content than that produced in the present experiments.

COMBINED MILLING AND DIFFUSION. **W. R. McAllep.** *Paper presented to the 7th Annual Meeting of the Hawaiian Sugar Technologists,* 1928.

Two principles are available for extracting the sugar from cane : the application of pressure and diffusion. With pressure alone, a large proportion can be extracted very cheaply ; say, four-fifths, half of the juice remaining after the first mill. With an additional pressing in a second mill, involving an increase of say 50 to 75 per cent. in the cost, a quarter perhaps slightly more, of the remaining juice can be extracted. If we repeat the application of pressure four or five times, we are able to extract but slightly over half of the juice remaining after the first mill and it will have cost more to extract this additional 10 per cent. than the first 80 per cent. Thus the application of pressure, while admirably adapted to extracting a considerable proportion of the juice economically, is fundamentally unsuited to obtaining "high" extractions. Diffusion has quite opposite characteristics. Providing one complies with the fundamental requirements for securing efficient diffusion work, fixed charges and operating expenses involved in securing "high" extractions are not proportionately very much greater than the cost of mediocre work. Diffusion alone, however, cannot meet the practical requirements. It must be supplemented with application of pressure before the bagasse can be used for fuel. Neither the application of pressure nor diffusion alone thus meets our requirements : a combination of the two principles is necessary. The old diffusion installations utilized the principle of application of pressure to a minimum extent ; in fact, to less than the practicable minimum, for the process failed principally because the bagasse was too wet to furnish sufficient heat. Our development of milling has gone almost to the other extreme. The application of pressure has been developed to a high state of efficiency, while the diffusion principle is applied at extremely low efficiency. We have partly offset low maceration efficiency by liberal applications of water, but there are limitations to the amount of water that can be applied, particularly as grinding rates increase. Even now, at some mills grinding at higher capacities, the maceration must either be reduced below what we are accustomed to regard as a reasonable amount or the principle of compound maceration cannot be adhered to very closely, thus still further reducing the efficiency. The logical solution of the problem would seem to be obtaining reasonable efficiency, if possible, from the water now applied rather than installing additional milling machinery. It is not apparent how any great improvement in maceration efficiency can be attained with easily installed and mechanically satisfactory apparatus, unless one departs somewhat from our conventional practice. Treating the bagasse from the first or second mill in a diffusion battery has been often proposed ; but on the basis of somewhat extensive experience with diffusion in the beet sugar industry, the writer does not consider this advisable. Should a diffusion battery be used, it would be preferable to suppress the preliminary milling entirely and depend on diffusion for obtaining the extraction. While the major factor that caused the failure of diffusion could be corrected without serious difficulty, the process does not meet the requirements of flexibility as well as milling, and further, we have large investments in milling machinery which could be operated to far greater advantage than at present if reasonable maceration efficiency could be attained. A fairly efficient continuous diffusion process, say after the second mill, would not be subject to many of the objections to the usual diffusion battery. Unfortunately however none of the many proposed schemes for continuous diffusion has been successful. Either they have not been workable mechanically, or they have possessed the equally fatal defect of requiring too great a quantity of liquid

in the apparatus in proportion to the material being extracted. The Perichon bagasse diffusion system, as has been used in Egypt, verges on a solution of the continuous diffusion problem, the principle of which could probably be developed to a fairly satisfactory point. With closely spaced mills, the Java method of installing maceration carriers between the mills as developed by NOBEL could not be followed.[1] On the whole, the preferable location for a maceration carrier appears to be outside of the mill, although this would necessitate the removal of bagasse for treatment and returning it to the mill. This need not be regarded as a serious obstacle, as bagasse has been conveyed from one tandem to another successfully, at Puunene and Paia, and this is still practised at Ewa. The writer believes that, particularly with more finely divided bagasse and more intensive milling, better results from the maceration carrier than have been obtained in Java could be obtained. It is improbable that more economical means will ever be developed for extracting the first 80 or 90 per cent. of the sugar from cane than pressure in a couple of mills (with ordinary maceration). From this point on, such procedure is poorly adapted to the work in hand. As the diffusion principle is much better adapted to this part of the work, does it not seem logical to depend more on it for completing the extraction ? For example, to remove the bagasse from the mill and extract the greater part of the remaining sugar by circulating the maceration water systematically in equipment such as that developed in Java. We could then reduce the bagasse to a suitable moisture content for fuel purposes with one, or preferably, two mills. The writer believes that operating in this way, extraction could be improved at a moderate cost, and that, with details properly worked out, we could grind at considerably higher capacities than at present without the installation of additional mills and still maintain a higher one than the present extraction.

METHOD FOR THE ELIMINATION OF COLLOIDAL MATTER. **Robert J. Brown.** *The Sugar Press*, **13**, No. 3, 14-15. Colloidal matter in beet juice is negatively charged and is readily coagulated through the addition of a positive colloid. Chromium oxide hydrosol proved to be the most effective and iron the least. But due to the higher cost of the chromium reagent and the greater difficulty of preparation of the colloid, the alumina hydrosol was adopted. It was found that when equal volumes of an alumina hydrosol, containing 1 per cent. Al_2O_3, and pressed juice were mixed a good coagulation of colloidal matter resulted, and the filtrate contained only a negligible quantity of colloidal matter. Work is in progress at present to devise a simple means of preparing the alumina hydrosol in order that its use may be introduced into beet factory laboratories.—FARMERS' PAYMENT FOR CANE. **Eduardo E. Saldana.** *Facts about Sugar*, 1929, **24**, No. 15, 345. In a book published by the author,[2] and reviewed by Dr. O. W. WILLCOX, a study is made of the different systems proposed, the conclusion being that payment will not have been put on the most stable basis until the sugar in the cane (or its value) is divided between mill and farmer in proportion to their respective capitals, costs, and risks, the ideal system being one which will stimulate the grower to produce a cane of good quality at a low cost and compel the mill manager to approach a high standard of efficiency and economical operation.—AN ERROR IN CHEMICAL CONTROL METHODS. **E. M. Copp.** *Facts about Sugar*, 1929, **24**, No. 9, 210-211. An error is caused if the method be adopted of calculating the sucrose and Brix in the incoming juice when the latter is weighed in the cold raw state and analysed in the usual way after the solids (suspended matter and settlings) have been eliminated. In a factory handling 955,723 tons of dilute juice during a crop, the scales took into account 3386 tons of insoluble solids not considered in the laboratory control. Hence the nett tons of juice were 952,336, a difference of 0·36 per cent. The reported tons of sucrose entering in the juice, viz., 119,539, were in error to an extent of 423 tons, and following this through to the retention figure, reported as 90·34, it is found that the correct retention, or sucrose in the sugar per cent. sucrose in the juice, is 90·67, a difference of 0·33.

J. P. O.

[1] See *I.S.J.*, 1927, 674.

[2] "Metodo Racional para el Pago de la Cana de Azucar." EDUARDO E. SALDANA, of Santurco, Porto Rico : published by the author.

Review of Recent Patents.[1]

UNITED STATES.

CENTRIFUGAL CLARIFIER FOR JUICE, ETC. **Ernst Kopke,** of Honolulu, T.H. 1,679,829. August 7th, 1928.

The invention relates to certain improvements in centrifugal separators of the general type disclosed in a prior patent.[2] It has for its object to provide the rotor with a gradually inclined interior surface between the side walls and the bottom, which will prevent packing of gritty material between the annular guide plate and the wall of the rotor. Also to construct the perforated screen for the annular guide plate of telescoping sections to permit the vertical adjustment of the annular plate and thereby vary the space separating the periphery of the latter from the wall of the rotor, in accordance with the character of the material being separated, liquors carrying a large portion of gritty material requiring a larger opening or space between the edge of the guide plate and the adjacent wall of the bowl or rotor than would liquors carrying slimy, colloidal or flocculent solid material. Referring to the drawings, 1 represents the wall of the stationary casing of the separator, 2 the upper flange and 3 the lower flange or curb, constructed and arranged as in the patent aforesaid. The rotor or bowl comprises a cylindrical wall 4, connected to a relatively flat bottom 5 by means of a gradually inclined interior wall section 6, which may be either plain or curved, the essential purpose of this inclined surface being to cause the solid material or mud to be forced over the same in an outward and upward direction into the separating chamber and prevent the accumulation or packing of the mud in this portion of the bowl as inevitably occurs when the joint between the side wall and the bottom of the bowl forms a right angle. Mounted above the bottom or lower flange 5 and concentric with the bowl is an imperforated guide plate, which may take any of the general forms shown in the prior patent aforesaid, but which preferably comprises a flat section 10 with a downwardly inclined or conical marginal flange 10′, the peripheral edge of which projects toward the curved or inclined surface 6 and defines an annular space through which the materials to be separated are forced by the centrifugal action. As hereinafter indicated, it is necessary and desirable that this annular space be adjustable as to size or area to insure effective and uniform separation of various types or characters of mixtures of solid or liquid materials and, to effect this object, the guide plate 10 is vertically adjustable with respect to the bottom or lower flange 5, so that the distance between the peripheral edge of the plate and the curved or inclined wall 6 may be varied at will, as graphically illustrated at *a* and *a′* in Fig. 2. The preferred means for vertically adjusting the plate 10 comprises two annular telescoping foraminated plates or screens 11 and 11′, the former being connected to the bottom 5 by suitable bolts and the latter being secured by any appropriate means to the underface of the guide plate 10, said telescoping screens being secured together in any

Fig 1

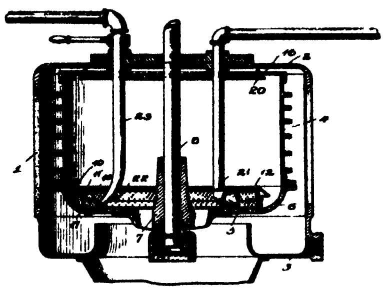
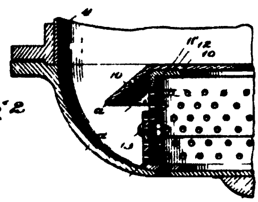


Fig 2



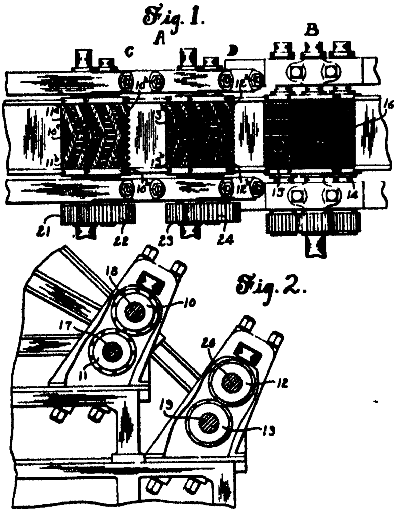
[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

[2] *U.S.P.*, 1,119,176; *I.S.J.*, 1915, 291.

desired relative vertical adjustment by means of bolts 13, which are passed through registering openings in the telescoping screens, as clearly indicated in Fig. 2. In operation, the liquor containing solid impurities, flows through the nozzle 21 into the accelerating chamber defined by the guide plate 10 and is driven by centrifugal force through the perforations in the telescoping screen sections 11 and 11', and is accelerated to the circumferential velocity existing at this point. It is further accelerated through skin friction in the constricted opening between the peripheral edge of the guide plate 10 and the adjacent inclined or curved wall 6 of the bowl. The solid impurities, which are heavier than the liquor, will at once tend to deposit on the wall of the bowl, which would have the effect of gradually closing the space or opening between the peripheral edge of the guide plate and the adjacent wall of the bowl, but, by reason of the gradual inclination or curvature of the surface 6, the solid material is forced upwardly and into contact with the inner cylindrical wall of the bowl, leaving the annular space practically unobstructed, so that the flow from the accelerating chamber into the separating chamber is maintained substantially uniform until the accumulation of solid material becomes so great as to necessitate stopping the operation and closing the bowl.

CANE MILL. **Franklin Farrel, Jr.** (assignor to the **Farrel-Birmingham Co., Inc.**, of Ansonia, Conn.). 1,696,943. January 1st, 1929. (Filed June 26th, 1924; serial No. 722,515).

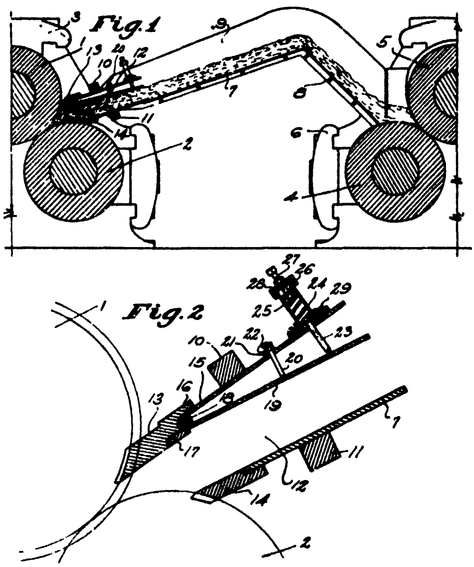
In a cane mill claim is made for a combination of parts as illustrated in the following example : A preliminary crusher *A* is arranged before a mill *B*. The number of crushing rolls may be varied as desired. The cane is crushed by rolls 10 and 11 of crusher *C* and is carried over inclined runways (not shown) to the second crusher *D* having the rolls 12 and 13 over the inclined bed, and enters between rolls 14 and 15 of the first roll stand of the mill *B*, comprising a plurality of three roll mill stands. In the example the rolls 10 and 11 are provided with grooves 10^a and 11^a which are substantially V-shaped in cross section. The provision of these circumferentially V-shaped grooves of the rolls creates correspondingly shaped ridges or ribs, and the ribs of the upper crusher roll are designed to enter the grooves of the lower crusher roll with a certain amount of clearance, as is customary. In order to provide teeth for hooking into the stalks and drawing them into the machine, the preferred practice is to cut a plurality of generally longitudinally extending grooves 10^b and 11^b in each of the crusher rolls 10 and 11, these grooves intersecting the transverse or circumferential grooves. The cross sectional shape of the longitudinal grooves just described, can be seen in Fig. 2. It is considered the best practice to provide an obtuse angle in each lengthwise groove, as shown at 10^c in Fig. 1, say, at an angle of 10° to the roll axis, as such an arrangement has given very good results in practice. The second pair of crusher rolls 12 and 13 are provided with teeth of a similar type, although the pitch of the circumferential grooves is less than that of the circumferential grooves of the first pair of rolls. The number of longitudinal grooves is the same in both pairs. The rolls 12 and 13 are provided with a series of circumferential V-shaped grooves 12^a and 13^a smaller in size than the corresponding grooves 10^a and 11^a of the rolls 10 and 11. However, in spite of the fact that the rolls of the second pair have circumferential ribs of less pitch, the number of longitudinal grooves is the same, so that the juice expressing surface is relatively increased.



The roll shafts 17, 18, 19 and 20 are provided with intermeshing gears 21, 22, 23 and 24 as customary. When the stalks are presented to the first pair of crusher rolls, they will be effectively drawn in by the teeth formed by the longitudinal grooves in the roll surface. In the second pair of rolls they will be broken up to a still greater extent. Owing to the fact that the longitudinal grooves of the second crusher are widely spaced, in spite of the use of relatively fine circumferential grooves the juice expressing action of the rolls of the second pair will be considerable, as well as the shredding action.

INTERMEDIATE CARRIER FOR MILLS. **Otto Franke** (assignor to **Birmingham Machine & Foundry Co.**, of Alabama). 1,698,088. January 8th, 1929.

In intermediate carriers (or chutes in which all moving parts are eliminated) the tendency of the bagasse to pack at the intake end, and thus to choke the carrier, can be avoided if the intake chute is provided with a yieldable wall so as to expand the cross-sectional area of the chute. In the illustrations the improved type of carrier is shown associating with the discharge side of the rolls 1 and 2 of the initial mill 3, and acting to deliver the stream or blanket of bagasse to the intake side of the rolls 4 and 5 of the succeeding mill 6. The carrier itself comprises a chute with a gradually sloping intake end 7 and a more sharply sloping and relatively shorter discharge end 8. The chute has side walls 9 which extend from scraper bars 10 and 11, which are disposed respectively above and below the intake chute 12 on the mill 2, to the mill 6. The chute is provided with an upper scraper toe 13 shaped and mounted to engage the roll 1, and with a bottom scraper toe 14 which engages the lower roll 2. It will be observed that the toe 13 has a top wall 15 of the chute mounted flush in its recessed end portion 16 and that it has mounted between this top wall 15 and a retainer plate 17 the cylindrical or hinge end 18 of a yieldable top presser plate 19. This plate 19 has mounted in the upper side thereof a stud screw 20 which projects through a slot in the top wall 15 of the chute and there receives a taper washer 21 held in position by lock nuts 22. This serves as a means to limit the downward swing of the presser plate 19 into the chute 12. Near its free end the presser plate is engaged by yieldable means such as the plungers 23, each having its head disposed to reciprocate in a spring barrel 24 in which is disposed a coil spring 25 seated at one end on the head of the plunger 23 and at the other end engaging the head 26 on an adjustable screw 27 threaded through the cap 28 of the barrel. The barrels are mounted on the top wall 15 of the chute by brackets 29 with the plungers passing through suitable openings in said top wall 15 and acting to hold the presser plate yieldably depressed into the chute to the limit permitted by the adjustment of the nuts 22 on the stud bolt 20.



In operation, as the stream of bagasse is discharged from the rolls 1 and 2 and collected by the toes 13 and 14, it passes in a stream into the chute 12 and is normally forced by the feed of the rolls 1 and 2 to rise up the inclined portion 7 of the carrier and to fall by gravity down its discharge end 8 to the succeeding mill. The yieldable presser plate 19 is set to give the desired thickness to the bagasse stream or blanket. Whenever, for any reason the bagasse tends to choke in the intake chute 12 of the

carrier, the pressure of the dense mass as it becomes compressed in the intake chute will overcome the resistance of springs 25, causing the presser plate to give and swing upwardly about its hinge end 18, thus relieving the congestion of the bagasse in the intake chute and permitting the feed to continue without interruption and with a substantially uniform depth of stream which gives a substantially constant delivery of the bagasse to the succeeding mill.

ACIDITY IN DEXTROSE MANUFACTURE. **Charles Ebert, Wm. B. Newkirk, and Meyer Moskowitz** (assignors to **International Patents Development Co.**, of Wilmington, Del., U.S.A.). 1,704,037. March 5th, 1929. Method of treating hydrol to increase its dextrose content which consists in subjecting the solution to a hydrolizing operation in the presence of sufficient acid to give the liquor an acidity of $pH = 2{\cdot}0$ or lower.—FERTILIZERS. **Fritz Rothe and Hans Brenek** (assignors to **Rhenania Verein Chemischer Fabriken A.-G.**, of Cologne, Germany). 1,704,218. March 5th, 1929. A process for preparing fertilizers comprises forming a mixture of mineral phosphorites which mixture contains for every molecule of P_2O_5 about one molecule of alkali metal oxide in the form of its salts and at least one molecule of silica, and for every molecule of silica such quantities of lime that in addition to an alkali calcium phosphate, calcium orthosilicate may be formed, and subjecting said mixture to a heating at a temperature of at least 900°C. in the presence of steam.—CENTRIFUGAL PLOUGH. **Carl Schaum** (assignor to **Fletcher Works, Inc.**, of Philadelphia, Pa. U.S.A.). 1,701,731. February 12th, 1929. Claim is made for the combination of a plough for centrifugal machines, and work and gear mechanism for effecting positive controlled vertical and lateral movement of the plough.—DEHYDRATING APPARATUS. **Harold S. MacKaye** (assignor to **Dry Fresh Process, Inc.**, of New Jersey, U.S.A.). 1,701,813. February 12th, 1929. Dehydrating apparatus comprises a group of ducts adapted to receive containers for moist material, means for producing and directing a current of hot gases under and through said group, and a layer of heat insulating material under said group adapted to shield the lower ducts from direct heat radiation.—SORGHUM THRASHING MACHINE. **Ralph E. C. Yockers**, of Smolan, Kas., U.S.A. 1,702,136. February 12th, 1929. In a thrashing machine, a housing, a fan casing communicating therewith, a fan in the casing, a screen frame, means for suspending the frame, a lower screen within the frame, a middle screen extending over part of the lower screen, an upper screen extending over portions of both of the other screens, and means for vibrating the frame, the main portions of the upper and middle screens extending on opposite sides of a vertical plane passing through their free and overlapping edges, and adjacent edges of these screens constituting discharge edges terminating approximately in said vertical plane, the flow of material over the discharge edge of the middle screen being retarded at that edge by material flowing from the upper screen.—CENTRIFUGAL. **Joseph J. Munson**, of Baton Rouge, La., U.S.A. 1,703,404. February 26th, 1929. In a continuously acting centrifugal machine, the combination of a carrier rotating about a variable axis, a plurality of cylindrical drying baskets mounted thereon so as to be free to rotate planetarily, a distibutor bowl surmounting said rotating carrier, spouts depending therefrom into said drying baskets respectively, said spouts being provided with discharge nozzles adjacent to said axis.—OXIDATION OF ALDOSES. **Arthur Stoll and Walter Kussmaul** (assignors to **Chemical Works, formerly Sandoz**, of Basle, Switzerland). 1,703,755. February 26th, 1929. A process for the oxidation of aldoses to the corresponding monocarboxylic acids, consists in treating the sugars in an alkali carbonate alkaline solution with chlorine in the presence of a salt of a halogen with higher molecular weight than chlorine.—CLARIFIER AND THICKENER. **Henry G. Schwarz**, of Denver, Colo., U.S.A. 1,704,993. March 12th, 1929. An apparatus of the character described comprises a tank with sides sloping to an outlet in its lower portion, having at opposite ends of a flow line in its upper portion, an overflow and a feed intake, and having an inclined surface above the flow line, and a dome on said surface and between the intake and overflow for the removal of supernatant matter.

UNITED KINGDOM.

MOUNTING MILL ROLLERS.* **Dhanjishah Bomonjee Cooper,** of Satara, Bombay Presidency, India. 302,135. February 22nd, 1928.

In the preamble to this specification, it is explained that in cane mills the most frequent source of trouble is the bearings for the roller shafts which are subjected to extremely heavy stresses which act mainly in one direction upon the bearing bushes and result in rapid wearing out of these bushes at one side, in particular if the lubricating arrangements are inefficient, thus necessitating frequent stoppages and replacement of the worn bushes. It is therefore the object of the invention to provide an arrangement for crushing rollers in which the bearing blocks or bushes are capable of withstanding the excessive wear due to heavy pressure for a relatively long period, and in which the lubrication is highly efficient, so that the friction is reduced to a minimum and risk of seizing of the bearings remote. In accordance with this object the mounting for the crushing roller comprises a pair of bearing blocks or bushes for the crushing roller shafts each of which is so shaped as to constitute a cylindrical wall portion extending around approximately one half of the bore for the shaft and a substantially thickened wall portion having two parallel surfaces, at the other side of the said bore. This thickened portion with its parallel sides adapts the block for slidable mounting in a guideway along which it can be adjusted for example in the known way by a screw and provides a substantial body of metal to be worn away at that side where the wear is greatest before the block becomes useless. In a mill the vertically disposed shafts will have an upper and a lower bearing block or bush. The upper bearing block may have an oil well formed in the thickened portion thereof and a pad of felt or like material disposed in a groove in the bearing surface of the block to which oil in the well has access. Also this upper block may have a rib extending across the oil well to prevent the collapse of the well or hollowed part of the block due to the pressure exerted upon the block by the shaft and taken up by the adjusting means, which will usually be a screw. The lower of the two bearing blocks is preferably closed at the lower end of the bore and has a helical oil groove in the surface of the bore in order to distribute the oil evenly over the wearing surface.

FIG.1.

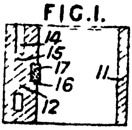


FIG.2

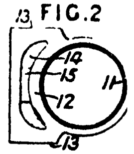


FIG.3.

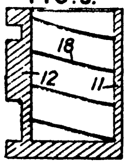
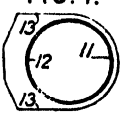


FIG.4.



Referring to the drawings, it is seen that the rollers of a crushing mill are mounted in a pair of blocks each having a cylindrical wall portion 11 on one side, and a thickened wall portion 12 with two parallel side faces 13 on the other side. The greatest pressure is taken by the portion 12, wear being taken up by adjusting the part 12 towards the shaft by a screw. The upper bearing, Figs. 1 and 2, has an oil reservoir 14 communicating with a groove 16 in the bearing surface. The reservoir 14 has a strengthening rib 15, and the groove 16, which may be helical, has a felt pad 17. The lower bearing block, Figs. 3 and 4, has a spiral oil groove 18. (Specification 297,283 is referred to).

CONFECTIONERY. (*A*) **R. W. Murray and Murray & Co., Ltd.,** of London. 303,241. November 2nd, 1927. (*B*) **A. G. Hulme, Baker, Perkins & Co., Ltd.,** and **Anciens Etablissements A. Savy Jeanjean & Cie.,** Soc. Anon., of Courbevoie, Seine, France. 303,605. November 7th, 1927. (*C*) **T. Zeller,** of Berlin. 304,181. June 29th, 1928; convention date, January 16th. (*D*) **B. Müller,** of Berlin. 305,236. February 2nd, 1929; convention date, February 2nd, 1928.

(*A*) In order to form compartments for packing caramels and like rectangular blocks of sweetmeats, a sheet of waxed paper or like suitable material is folded so as to form parallel channels. A strip, the width of which is equal to the width of the channels, is folded so that when it is disposed a series of compartments is formed in which individual caramels are packed. (Specification 224,132 is referred to). (*B*) Crystallization of sweetmeats is effected in a single vessel, the vessel being charged

with syrup which is heated and circulated and then cooled, or allowed to cool, the goods being introduced into the cool syrup and allowed to remain during the crystallization period. The syrup is reconditioned after the removal of the goods. (*C*) In the preparation of fresh cocoa beans, the known fermentation process is interrupted at the termination of the alcoholic fermentation and before the beginning of the acetic fermentation. The fermentation is interrupted by the application of heat, a temperature of between 45 to 70°C., and preferably between 55 to 65°C., being maintained for about 24 hours in order to complete the decomposition and loosening of the mucous covering. The beans are then washed, and thereafter dried. (*D*) To control the fermentation of cocoa beans, they, freed from the pods, are placed in receptacles which are fitted with ventilating devices and made of such a size that overheating is avoided, the beans remaining without disturbance until the fermentation is completed. The fermentation is continued until the alcoholic fermentation is completed, but the formation of acetic acid is avoided.

UTILIZING WASTE MOLASSES. **Y. Takayama,** of Tokio, Japan. 304,071. March 13th, 1928. Potassium chloride and betaine hydrochloride are separated from waste molasses by treatment with hydrochloric acid or by passing hydrochloric acid gas; crude potassium chloride separates out, and is filtered off. The filtrate is concentrated until crystals of crude betaine hydrochloride, containing potassium chloride, are obtained. These are filtered and dissolved in water. The aqueous solution is neutralized with lime or calcium carbonate, giving potassium chloride and free betaine; it is concentrated further and the potassium chloride crystallized out. The betaine hydrochloride may be regenerated by the addition of hydrochloric acid to the filtrate or by the addition of sufficient sulphuric acid to precipitate the calcium as sulphate, at the same time converting betaine into betaine hydrochloride.—YEAST PRODUCTION, USING MOLASSES. **Selbi Soc. d'Exploitation de Licences de Brevets Industriels,** of Geneva. 304,314. January 7th, 1929; convention date, January 19th, 1928. Vinasses from molasses distilleries, sugar or yeast factories are used either alone or with molasses or other vegetable hydrocarbon material for the production of yeast. In an example the leaven or pitching yeast is cultivated in molasses or sterilized vinasse, adding the required amount of ammonium sulphate and sodium phosphate. Boiled dilute vinasses, preferably slightly acidified, is introduced into the fermentation vessel already containing the leaven. Superphosphate is added and the fermentation allowed to proceed. The resulting yeast is separated and dried.—EVAPORATORS. **W. Rusiecki,** of Inowroclaw, Poland. 304,670. January 23rd, 1929; convention date, January 23rd, 1928. In evaporating salt, sugar, etc., solutions in apparatus consisting of a heating body and a separator connected together by an internal or external pipe, the liquid heated in the heating body is kept by the column of liquid in the separator, together with the pressure of the steam or air above it, at a pressure which exceeds the pressure of saturated steam at the temperature reached by the solution at its outlet from the heating body and the cross-sectional area of the flow of liquid from the heating body does not exceed the area of its flow through that body.—PURIFYING ALCOHOL WORTS. **Distilleries des Deux-Sèvres,** of Melle, Deux-Sèvres, France. 304,758. December 12th, 1928; convention date, January 26th. In separating liquids miscible with water from liquids which are insoluble or only slightly soluble therein, the mixture to be separated is fed into a distillation column and a current of water is sprayed into the upper part thereof. The mixture is fed into the middle part of the column as a vapour and the water is preheated to the temperature of the azeotropic mixture which is formed by the water and the insoluble or slightly soluble liquid. The base of the column is heated and the vapours of the azeotropic mixture, which escape at the upper part of the column, are condensed to obtain a liquid which separates into two layers, one layer consisting of the insoluble or slightly soluble liquid together with a little water, and the other being returned to the column from the base of which a mixture of water and miscible liquid is collected. In purifying alcoholic worts, the worts are introduced at the temperature of boiling, the water spray is heated to about 98°C. and dilute alcohol freed from impurities is collected at the base of the distilling column.

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to April 27th	1,412,778	..	1,267,067
Deliveries „ „	1,204,370	..	1,019,200
Meltings by Refiners „ „	1,022,354	..	894,900
Exports of Refined „ „	32,000	..	27,864
Importers' Stocks, April 27th	306,639	..	356,407
Total Stocks, April 27th	553,379	..	516,553
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT MARCH 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	1,098,473	..	899,297	..	1,333,984
Stocks	1,310,348	..	1,185,044	..	1,296,744
	2,408,821		2,084,341	..	2,630,728
Local Consumption..	26,000	..	21,141	..	25,038
Receipts at Ports to March 31st ..	2,434,821	..	2,105,482	..	2,655,766

Habana, March 31*st*, 1929. J. GUMA.—L. MEJER.

Beet Sowings in Europe.

F. O. Licht's Estimate for 1929 *and Previous Seasons' Sowings.*

(Estimate)	1929-30 Hectares.		1928 29. Hectares.		1927-28. Hectares.
Germany	430,000	..	430,521	..	406,739
Czecho-Slovakia	240,000	..	250,475	..	281,321
Austria	30,000	..	27,836	..	23,529
Hungary	68,000	..	65,503	..	62,353
France	250,000	..	242,370	..	230,425
Belgium	63,000	..	63,217	..	71,380
Holland	52,000	..	65,255	..	69,002
Denmark	30,000	..	41,200	..	39,700
Sweden	24,000	..	42,623	..	40,555
Poland	225,000	..	220,512	..	198,032
Italy	120,000	..	112,000	..	93,240
Spain	80,000	..	75,000	..	65,000
Great Britain	99,000	..	77,270	..	100,247
Other Countries	140,000	..	146,173	..	162,249
Europe without Russia	1,851,000	..	1,859,955	..	1,843,772
Russia	759,000	..	759,000	..	640,000
Europe including Russia	2,610,000	..	2,618,955	..	2,483,772

United Kingdom Monthly Sugar Report.

Our last report was dated 9th April, 1929.

Conditions throughout the world have been abnormal and markets generally have been flat and easier, the lowest prices since the war having been registered.

The White Terminal Market has been active and prices generally declined. May fell from 11s. 1½d. to 9s. 11¼d., August from 11s. 8¼d. to 10s. 6d., December from 12s. to 10s. 10½d. and March from 12s. 3d. to 11s. 3¾d.

The Raw Terminal Market has still shown much heavier registrations than White sugar, and although prices have fallen, the fall is not so great as in the White sugar. May has sold down to 8s., August moved from 8s. 10½d. to 9s. 1½d. to 8s. 1½d., and December from 9s. 3¾d. to 8s. 6d., whilst March fell from 9s. 7½d. to 8s. 9d.

The latest prices are : —

	MAY			AUGUST			DECEMBER			MARCH	
	s.	d.		s.	d.		s.	d.		s.	d.
White	10	0	..	10	6	..	10	9¾	..	11	3¾
Raw	8	0	..	8	1½	..	8	6	..	8	9

Dealings in actual sugar have been small and although it was thought that after the Budget a large trade would ensue, the market was disappointing in the actual turnover, and the demand is very slow.

Refiners made three reductions in their prices, 3d. on the 24th April, 3d. on 1st May, and 3d. on May 8th, the latest prices being, No. 1 Cubes 25s. 9d., London Granulated 22s. 7½d. Prices for Home Grown are also easier, the latest prices are 22s. to 21s. 9d. less the usual 4½d. rebate.

Continental Granulated has been easier. The value of Dutch Granulated is 11s., while Czecho Granulated has been offered ready, down to 10s. 3d.

A fair business was done in Raws last week. Cubans and San Domingos sold at 8s. 10½d. to 9s. for May and June shipment.

The American market is easier, and although at one time there was a slight improvement the price of Raws, c.i.f. New York, has fallen to $1\frac{1}{1}\frac{3}{8}$. The Futures market has fallen from ten to fifteen points.

With regard to Europe, F. O. Licht has issued his first estimate of the sowings, excluding Russia, at 1,862,000 hectares, against 1,873,000 last year.

The Cuban production to date is given as 4,850,000 tons, whilst exports are 2,000,000 against 1,400,000 tons. The stock in the island is about 250,000 tons larger than a year ago.

21, Mincing Lane,
London, E.C.3.
May 10th, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 366. JUNE, 1929. VOL. XXXI.

Notes and Comments.

The General Election Results.

The General Election for Parliament that took place in the United Kingdom on May 30th resulted, as some keen observers had feared, in no one party getting a clear majority over the other two. The results were complicated from the fact that in the vast majority of cases there were triangular contests in the constituencies and at first glance it appeared that in about 80 instances, the Liberal candidate coming third (in at least 40 cases a bad third) had merely spoilt the anti-Labour vote and let the Labour candidate in. This assumption is hotly contested on the Liberal side, and probably time and much impartial investigation will be needed to establish its accuracy. The net result, however, is that instead of the Conservatives being at least the largest party, they number about 30 fewer than the Labour one, and since the Liberals after strenuous efforts and the contesting of over 500 seats have been unable to raise their representation by more than a round dozen, and number under 60, the largest party in the new House of Commons is the Labour one, and Mr. BALDWIN has taken the only logical step and resigned. For the second time since the War, Labour is now forming a Government. Whereas the first time it was only the second largest party, and virtually ruled by consent of the Liberals, the second time it ranks as the largest; but it still lacks a sufficient majority to be independent of the other two parties in combination. Its coming policy will therefore have to be dictated by tactical considerations and it hardly seems likely that any advanced programme will be attempted, at any rate not till some later session when a programme for appealing to the electors to return Labour to absolute power is presented to the country.

The question inevitably suggests itself: How will the new Government view the special sugar legislation of its predecessor? And will it be content to leave it in being, or shall we witness some more or less drastic reversal of policy? Certain *obiter dicta* of prominent Labour leaders of late years suggest the latter; but when it comes to deciding, in the seat of office, other considerations and influences may well come into play. At the moment of writing the composition of the new Cabinet is not known but it is assumed that Mr. PHILIP SNOWDEN is to be the Chancellor of the Exchequer as previously.[1]

[1] As we prepare for press we learn that Mr. PHILIP SNOWDEN'S appointment is confirmed. The new Secretary of State for Dominion Affairs and the Colonies is Mr. SYDNEY WEBB—rather a surprise selection, but one which the *Times* declares will give considerable satisfaction.

Now there are three aspects of the matter in regard to sugar legislation. First, the beet sugar subsidy at home; second, Imperial preference for our overseas cane sugar; and, thirdly, the incidence of the import duties which gives to the home refiners a virtual monopoly of the import trade. As regards the beet subsidy, this was jointly sponsored by the last Labour Government, and since it is a gradually disappearing factor, it may be assumed that it will be allowed to complete its course. As regards Imperial preference it is known that some of the new Cabinet, particularly Mr. THOMAS, are sympathetic towards it; others have a more open mind than was once the case; but it is bound up in the existence of sugar duties, and sugar being a "breakfast table" commodity, it is to be feared that Mr. SNOWDEN will desire as soon as he can spare the money to free it from all taxation. He is probably the most doctrinaire Free Trader in the new Government and he abhors differential taxation. As for the advantages conceded to the home refiners by the 1928 Conservative Budget, no one waxed more indignant about them at the time than Mr. SNOWDEN, and it is not to be expected that he will favour their continuation. In any event these advantages are bound up in the existence of sugar duties, and if these are abolished unreservedly the way would be open once more for the competitive entry into this country of foreign refined sugar.

But whatever the Labour Government decide to do, they will of course need to avoid running counter to the convictions of the other parties in the House, or else will invite a successful adverse vote. It is hardly likely, however, that Mr. SNOWDEN's views on free trade will be challenged by the Liberals, who are nothing if not free traders themselves, so if the Labour party were so ill-advised as to decide to drop Imperial preference, they would probably get an absolute majority in the new House. But Labour needs money wherewith to finance its new schemes of domestic reform, and existing taxation may conceivably be left in force for the time being, so it does not follow that any rapid reversal of existing policy is an inevitable consequence of the present change of Government. In any event, the indications seem to point to next Spring as the earliest date when a characteristically Labour Budget may be expected.

The American Tariff Bill.

The new U.S. Tariff Bill which raises the duty on foreign sugar to 3 cents a pound and on Cuban sugar to 2·40 cents (thus providing a new margin of 60 points instead of 44), has been passed by the House of Representatives, and now awaits the consideration of the Senate. A Finance Committee of the latter will, however, consider it first, and some six to ten weeks is expected to be occupied in preliminaries ere the bill comes before the Senate proper. This latter event is consequently not expected before September. But since President HOOVER is said to be in favour of the new scale of sugar duties, the probability of the passing of the measure grows stronger.

It is naturally designed to give increased protection to the sugar industry of the domestic and insular regions of the U.S. These industries are not those in the world which turn out sugar the most cheaply, and of late they have undoubtedly felt the effect of the low world prices for sugar that have persisted thanks to the dominant position of production over consumption. The sub-committee in charge of the sugar section of the bill elicited the fact that the duty paid price of 96° sugar in the New York market for several months past has been 3·76 cents a pound or less, and that the domestic industry could not survive at that price level. So a further step is contemplated in protection

at the expense of the foreign producers ; and though Cuba gets an increased margin as compared with rivals in the same category, the net result for her promises to be the further reduction of her profits by a more or less appreciable proportion of the increase in duty, because she comes into increased competition with Louisiana, Hawaii, Porto Rico and even the Philippines. How Cuba is going to stand this further inroad into her profits with sugar prices at present levels, it is difficult to see. The only loophole would appear to be provided by the incidence of the scale of the new duties. Under the new scheme the rate of increase per degree starts at 94°. Hence 96° sugar will be penalized, and a 94° raw sugar basis will tend to force itself on those who wish to escape the penalty. In other words, Cuba can resort to making a low test sugar if she cannot shoulder the increased duty. But the production of sugar testing 96° is so firmly established a custom in the trade that the adoption of any new basis is to be deprecated. Moreover, it is not certain that the Cuban producer's saving in duty by sending 94° crystals into the American market may not be more than counterbalanced by the lower prices this sugar would fetch from the refiners.

The Geneva Investigations.

The League of Nations enquiry into the economic position of sugar production continues, and the beet sugar experts have latterly had their say. We give elsewhere the official report of the proceedings at Geneva when these experts were examined by the Economic Committee of the League. The enquiry revolved round ways and means of reducing over-production and the part the beet sugar industry might play in the task. It was made clear that the position of sugar beet in crop rotation was a firmly established one in European countries, and could not be divorced from the general agricultural problem. It was realized that cane sugar production is generally regarded as a serious menace to beet ; on the other hand, the opinion was expressed by a minority of the experts that protectionist measures in favour of beet production constitute a greater danger. This is only one particular asseveration of a growing belief that the present uneconomic position of sugar production is being aggravated by the persistence of high duties destined to encourage domestic productions, because these are thereby largely relieved of the consequences of unprofitable prices such as harass a free market. But even if the League of Nations can see its way to advise the offending States to reduce the extent of the protection accorded such domestic productions, it remains clear that any attempt to relieve the present situation must be a matter of private negotiation between the principal producers concerned, and must take the form of rationing exports of such surplus sugar as is not wanted for home consumption. As a German writer remarks, no one has apparently been able to offer a better plan than that which the Cuban Government put forward through Colonel TARIFA, whose crop limitation policy in spite of the violent attacks it was subjected to in some quarters had much to commend it, and which failed chiefly owing to the unexpected yield of the new Java cane, POJ 2878. For the abandonment of that restriction policy has not been followed by the improvement in the sugar market such as its opponents counted on.

Whether there is any direct material outcome of the Geneva enquiry or not, it may be hoped that it will provide the spur to bring along a renewal of the private negotiations between the principal producers of cane sugar for export. Some means for relieving the market for good of certain excess quantities of sugar (that otherwise can be released at any moment however

inopportune) must be devised. It is suggested in some quarters that this excess could be denatured and used for cattle food or else for making alcohol. Even if it were actually thrown away, it is argued that any loss therefrom would be more than made good by the immediate increase in market value of the remaining sugar produced. But the equitable problem would be to spread the loss so that it did not fall only on one or two sections of the industry and this would prove a difficult task to formulate.

Queensland Politics.

While the general election in this country has put Labour in power as being the largest single party, the Queensland electorate has at length put an end to the long term of office of the Labour party in that State, where under different Premiers there has been 14 years of labour rule. As a Melbourne paper says, "Labour in Queensland has enjoyed an unexampled opportunity : it has failed all along the line. Its path is strewn with the corpses of its own schemes, every one of which is associated with bad finance and huge deficits piled up in State undertakings." It has suffered also from its own extremists, for the last Premier, Mr. McCORMACK, has been fighting his left wing for the past 18 months, and the railway strike in 1928 and the labour troubles in the cane tracts amongst others may be put down to the fact that both legislation and administration have been too much directed towards helping political supporters instead of aiming at assisting the staple industries, which are mainly pastoral and agricultural. The impression one has received of the sugar industry in Queensland during those 14 years has been one long struggle to reconcile the demands of the workers with the economic limits of the industry viewed as one unit of a world-wide undertaking, in which contest the Government of the day have invariably endeavoured to give the workers the utmost support that the circumstances would permit. The result has been that the industry has carried on with difficulty and has only been maintained by an advanced system of protection, to the cost of which the whole of the Commonwealth has contributed. The new Government proposes to repeal all enactments that are hampering industrial enterprise. It will be interesting to see what if any early changes are made in connexion with the sugar industry itself.

Australian Government Control of Sugar Renewed.

For the moment, however, according to a cable message to the *Times*, the Commonwealth and Queensland Governments have renewed an agreement for the control of the Australian sugar industry. It is provided that the Queensland Government shall acquire all raw sugar manufactured from cane grown in that State during the seasons 1928-29, 1929-30, and 1930-31, also the smaller New South Wales production. It undertakes to sell all grades of sugar and sugar products in all the capital cities at the same price. The wholesale price for refined sugar has been fixed at £37. 6s. 8d. Manufacturers of fruit products will receive supplies at £30. 6s. 8d. a ton. The Queensland Government agrees that, in respects of sugar content of manufactured goods exported during the currency of the agreement, it will pay to the exporters a rebate of the amount in excess of the Australian home consumption price over the Australian in-bond equivalent of the world's sugar parity price of such sugar contents, and it accepts on behalf of the sugar industry responsibility for any loss arising from the exportation of surplus sugar from Australia.

Notes and Comments.

West Indian Crop Reports.

The following is the gist of Barclay's Bank Reports on the British West Indies during the last four months. *Barbados.*—The autumn rains benefited the growing crops, but by April more rain was wanted and in May conditions were very dry. Canes have been in good condition, and while the yield is not now expected to be up to that of last season, the quality of the juice is reported to be satisfactory. The present low level of prices is naturally causing considerable anxiety and the problem of reducing working costs is occupying the serious attention of the planters. It is intended to restrict the output of molasses to a figure much below the 1928 production. The work of the Department of Agriculture has reached an interesting stage in connexion with cane moth-borer parasites. These have been extensively cultivated by the newly-appointed Entomologist, and it is hoped that the distribution will have considerable effect in destroying the moth-borer pests. *Trinidad.*—Weather conditions have fluctuated from month to month. Till January it had not been favourable to cultivation generally; in February it was favourable, in March very dry with rain badly needed, while in April the rainy season was due. Canes ripened well and the crop season which began in February, although not expected to reach the high level of 1928, is proceeding satisfactorily; the yield both in quantity and quality is good, juices exceptionally so. The froghopper pest has caused very little damage this year. *Jamaica.*—The weather as a whole has been favourable, though there have been dry spells. The crop now being reaped is expected to be larger than for some years past, but prices are unfortunately very low. *Leeward Islands.*—Weather conditions have been mostly favourable for the crop and as a result the sugar cultivation has made a very noticeable recovery from the effects of the hurricane of last September and the shortage is not likely to be as considerable as was at first anticipated. In Antigua the crop is estimated at 12,000 tons, while in St. Kitts one of 14,000 to 15,000 tons is looked for. *British Guiana.*—The 1928 final crop gave a satisfactory yield, while for the first 1929 one the yield is said to be up to expectations. The rains have been sufficient.

The Late Mr. John Laidlaw.

The late Mr. John Laidlaw, whose death we briefly announced in our last issue, was one of that distinguished band of Glasgow sugar machinery engineers whose name is a household word in sugar circles all over the world. He possessed an intimate knowledge of the requirements of the sugar industry, and in engineering circles was considered an authority in his own line of business. This was not of course confined solely to sugar machinery, as his firm also constructed centrifugals or hydro-extractors for the textile, laundry, and chemical industries, the demand for these machines coming also from all parts of the world.

Mr. Laidlaw, after an earlier apprenticeship with a millwright at Selkirk, served for a time with Messrs. Mirrlees, Watson & Co., of Glasgow, and in 1883 joined with Sir William Renny Watson in establishing the firm of Watson, Laidlaw & Company. Here he devoted his energies to improvements in sugar centrifugals and through his efforts it was not long before the Watson Laidlaw machine obtained a world-wide reputation. Mr. Laidlaw was a member of the Institution of Engineers and Shipbuilders in Scotland; and, as showing the respect in which he was held in Glasgow, the name of the street in which his firm was situated was a few years ago, under a re-naming scheme, changed to Laidlaw Street, in compliment to him.

Cane Breeding Work in Barbados.

The raising of seedling canes has during recent years fully established itself as the major line of research in all the chief cane growing countries. And this has not been entirely owing to the fact that by this means new varieties, with richer juice and greater yields, have been introduced into the plantations, but also that gradually it has become evident that most of the difficulties in plantation work can be influenced if not eliminated along these lines. New seedlings are therefore being called upon to satisfy more and more conditions : rapid and even sprouting of the sets, early closing in of the plant to reduce the danger period when the ground may be dried out or invaded by weeds, early or late maturing so that the harvesting season may be lengthened, erectness of growth and free shedding of leaves to render reaping easier, keeping power of the juice after the canes have been cut so as to prevent losses in unavoidable delays between cutting and crushing and, perhaps more important than all in most countries, ratooning power—all these are demanded of the new seedlings. But with more intensive methods of plantation work the cultivated canes have gradually become less resistant to adverse conditions whether of soil or climate or the attacks by insect pests and fungus and bacterial diseases. Resistance, in its widest sense, has now become a leading character required in any new seedling ; and great triumphs have been recorded in this direction. But, hitherto, all this work has tended to specialization : the seedlings which have revolutionized the industry in one country have been eagerly sought all over the cane growing world, with the disappointing result that they have generally failed to live up to their local promise when introduced elsewhere. This is one of the main differences between the high class seedlings of the day and the grand old canes which spread over the tropics in the last century. And the lesson has only been gradually learnt that each country of any importance must raise its own seedlings if it is to be certain of success. It is not that the high class canes under the new conditions belie their reputation as yielding abundant juice of high quality, so much as that they simply are not at home and are surpassed in yield by the local standard varieties. Acclimatization may have something to do with this difficulty, and cases have occurred where a variety with a good reputation has after a few years of failure almost suddenly shown its true nature under the new conditions. But there is obviously a factor here concerned which has been neglected in the seedling work : it is somewhat extraordinary how little attention has in the past been devoted to a true understanding of the underground parts of the canes in the plantation. The roots which are connecting link between soil and plant, its food taken in and the resulting production of sugar, have only of late years received any attention at all ; and even now there are very few countries which specially concern themselves with this matter in their seedling work. It is not sufficient merely to observe that there is a "strong rooting system," or a "deep rooting system" in a seedling ; but as much study should be devoted to this part of the plant, if not more, than to the canes and leaves above ground. It is unnecessary to labour the point, for when one comes to think it out, it lies chiefly in the root system that the adaptability of a plant to its surroundings is achieved. Some will stand drought or brackish conditions, even grow in deep water, and others have been met with which have a wide range of resistance to adverse conditions of any kind. Never before has so much attention been paid to the cane roots as at present, but this is merely the commencement of the subject. There are evidences, for instance, that the specialized seedling phase may be approach-

ing its limit ; and if this is the case, it will almost certainly be owing to increasing knowledge of the root systems of the parents used. To give instances offhand of what appear to be wide range canes, Badila appears to be a cane of great adaptability, but we have no knowledge of its ancestry ; the cane of the day is POJ 2878 which in Java is reported to be a sort of Admirable Crichton among canes and is under trial in various other countries ; and in north India Co 205 is stated to be strongly drought resistant and yet capable of growing in water three feet deep. In the two last named we have a clear knowledge of their immediate ancestry, and both of them have the " blood " of *Saccharum spontaneum*, whose roots exhibit just those characters mentioned as being shown by Co. 205. The Java success suggests that the wide range canes of former days may be a possibility in seedling work in the near future, even under the intensive cultivation of the present day, with all its faults.

Barbados was at one time pre-eminent among cane growing countries for its seedling work, and some of the many excellent varieties raised there are still being grown in many parts of the world, indicating that the island is inherently suitable for such work. During the past few years there have been many summaries in this Journal of the advances made in the technique employed, especially in Java, India and Hawaii, and now that there appears to be a recrudescence of its old time activities in Barbados, we gladly turn to the Reports received of the work of the Agricultural Department for the past two years. The officers in charge of the breeding work have taken full advantage of the progress made elsewhere, and the major part of the reports referred to is devoted to detailed descriptions of the seedling work, including the steps taken by Barbados to place itself in the front line with recent work elsewhere. As will be seen, the work is of a high order and although prosecuted under great difficulties has important contributions to make to the elucidation of this complex subject.

In spite of its being practically entirely devoted to the sugar industry, the island is debarred from the use of irrigation, but is constantly reminded that its rainfall is a variable quantity. The average rainfall for 60 years is given as 60·71 in. over the island, but in 1926 was only 54·58 in. The following analysis is given of the effect of the rainfall on the crop of 1926-1927 : in December, 1925 a record low rainfall checked the " spring " of the young canes : in January and February the rains were slightly above normal, but an unusually severe drought occurred from March to May : moderate rains fell from June to September, followed by heavy rains from October to December, and frequent showers during January to February 1927. The effect of this distribution of the rainfall was heavy tonnage of canes with low sugar content. In the following year the rainfall was more favourable, and the young canes never lacked moisture, in fact appeared to be pushed on rather too rapidly (with a great amount of arrowing later) : a dry spell was experienced from July to September, being followed by good to heavy rains until January, and a dry spell in February with a severe drought in April and May. With such a degree of uncertainty and unreliability in the rainfall year by year, seedling work would be seriously hampered ; and it is not surprising to read that a local irrigation system by means of an electric pump has been installed at Codrington, the most important experiment station. Owing to a serious shortage of staff, all breeding work was however concentrated in 1927-1928 to Cane plantation, so as to be enabled to get through the work. Here the average rainfall is over 80 in. and the elevation over 1000 feet, and all the canes grown there arrowed during the season.

For testing seedlings produced 22 estates have been selected in differing localities on the island : 10 on the low black soils, 3 on medium black soils, 4 on medium red soils, 4 on high red soils, and 1 in Scotland district. The machinery for this later work thus appears to be exceptionally good ; but the many tables given showing the resulting analyses cannot be referred to in this article, which will be confined to the technique developed in obtaining the seedlings.

During the year 1926-27 the breeding work was under the charge of L. C. C. LIEBENBERG. All of the arrows were obtained from 10 mothers growing in the open fields, and over 30,000 seedlings were potted. Roughly, these consisted of over 10,000 with Ba 11569 as mother, 6000 from B 381, 4000 from B 663, 3000 B 374, 2000 from B 606, and 1000 each from BH 10 (12) and SC 12 (4). The following special lines of study were pursued during the year : An attempt to apply the method so successfully employed at Coimbatore for obtaining rooted arrows, a trial of the sulphurous acid method of Hawaii, to which were added tests with ammonium fluoride and hydrofluoric acid, observations of the flowering habits of the different varieties, lantern work for selfing and crossing experiments, pollen germination tests, seed germination experiments, tests as to germination in sun and shade, and so on. Some of the most interesting results are referred to below.

The attempts at obtaining rooted arrows for isolation purposes were not successful. For one thing, the arrows after showing that their canes were rooted, were collected in barrels of soil and taken to Codrington, and suffered injury in the process, so that none emerged fully. Also there was a variation in the method adopted for holding the soil round the cane stem, owing presumably to the absence of the convenient tile half-pots commonly used for roofing at Coimbatore. In place of these, " baskets " were made which could be opened and closed lengthwise, and which consisted of wire netting cylinders lined with sacking and supported on a wooden base, so as to hold the earth securely round the canes where the root eyes were desired to " germinate." No success was, moreover, secured with the attempt at growing the arrowed canes in sulphurous acid or the other solutions tried ; the canes died as by poisoning and not from wilting, and this failure is deserving of further elucidation.

A detailed study was meanwhile made of the flowering habits of different cane varieties. Variations were noted in the colour and size of the floral parts, the time of flower opening, the order in which the flowers on a spike opened, the hour at which the first flower opened, the relative fertility of both male and female organs, the number of anthers opening, the amount of pollen shed, and the number of seedlings produced. Some interesting observations are given as examples. It was noted that the flowers of BH 10 (12) usually opened very early in the evening, namely about 9 p.m., and much pollen had already been shed when Ba 11569 flowers opened some hours later. Other varieties only opened sparingly before 3 a.m. In Ba 11569 the anthers contained little pollen, and little or none was seen under the lens on the stigmas ; BH 10 (12) on the other hand showed the stigmas well covered by pollen. In spite of these differences, the former produced many seedlings while the latter produced very few. B 147 like BH 10 (12) opened its flowers very early in the evening, but did not shed its pollen till about 3 a.m. ; then the stigmas were literally plastered with pollen, but no seedlings were produced. B 381 behaved in an exactly similar manner, suggesting that these two seedlings may prove valuable as mothers in crossing work.

A further point of variation noted in these observations relates to the time elapsing between the emergence of the arrow and the opening of the flowers. As an example, in Ba 11569 and Ba 6032 the flowers commenced to open two or three days after emergence, while in BH 10 (12) this did not occur for a week or ten days. These, however, are regarded as the extremes, and the other varieties tested ranged themselves between. No definite relations were noted between temperature and relative humidity and the special peculiarities of the different varieties in the opening of the flowers, the dehiscence of the anthers, shedding of pollen, and dropping of anther sacs. The ordinary effects were observed, namely that humidity caused the anthers to emerge but prevented dehiscence, and so on. Under field conditions very few flowers opened when the temperature exceeded 85°F., i.e., after about 8-30 a.m., and anther dehiscence was most abundant at a temperature of 73-74°F., that is after 6 a.m. All of the observations here recorded were obviously of importance for the crossing work to run smoothly, and especially where differences in behaviour had been noted between any two parents which it was desired to cross. For example, it would be difficult to obtain seedlings of B 417 or B 381, while it should be possible to obtain crosses between BH 10 (12) or B 374, where the pollen is shed early in the night, and Ba 11569 whose anthers only shed their pollen late in the morning. The technique by which the observations were made will be referred to later.

Cages, termed " lanterns " locally and of unusually solid structure, were used for isolation of arrows in crossing and selfing work. For crossing, various serious attempts at emasculation were made, owing to a report that this had been successfully accomplished by a worker in Cuba. After trial, forcibly blowing the anthers off did not recommend itself. Although a great many were thus removed, some remained ; and as fresh anthers kept emerging all through the night it would mean working for many hours in one spell. Removing the anthers by a camel's hair brush was more effective, but liable to the same objection ; and this method appeared also to injure the stigmas slightly. Keeping the anthers moist was more complicated. It was very conveniently done by a " Flit " atomizer (also used for blowing) : emergence was encouraged, but dehiscence prevented. But when the fine water spraying ceased the anthers quickly dried and shed their pollen. The question also arose as to the effect of this moistening upon the stigmas, and certain moulds were apt to put in an appearance. On the whole there appeared to be little chance of success along these lines.

Experiments in germinating pollen were not successful. A glass plate thinly smeared with " gloy " was held in the air to test the numbers of pollen grains afloat at a time when there were very few arrows in the field. A series of substances were tested as to their suitability for planting the arrows for germination of the seeds, with the general result that the character of the material and treatment made very little difference, but that pure surface soil which had always been used was perhaps the best. The addition of charcoal was made in a casual way and appeared to have a distinctly stimulating effect (because of the oxygen absorbed ?), and this was recommended for further trial. In studying the further growth of the young seedlings a curious difference was observed between those grown in the sun and in partial shade. In the latter, there was no differentiation as between individuals, and excepting slight differences in height there was nothing to make use of for the purpose of early selection. " The plants in the sun were remarkably different. Almost immediately after germination differentiation seemed to set in, and soon

after every plant appeared to be a distinct individual . . . and differences in colour, robustness, habit, roots, size and leaf width were very conspicuous." On placing shaded plants in full sun, a few died, some suffered, but after a few weeks "a remarkable change was noticeable and the condition now corresponded with that of those in the sun from the start. Some were green, others were red, some were thin, others were robust; but they were much behind those grown from the first in the open."

A specially careful examination was made of the roots of the young seedlings of different parentages, and as noted by other workers some diversity was noted. For instance, B 374 seedlings produced a few long lateral roots which did not branch as much as the denser root systems of B 663 and B 606. The importance of the root characters is fully acknowledged for future breeding work, perhaps especially for ratooning powers. The rest of the Report is devoted to the study of the seedlings after potting. Reference is made to the economical system of watering "described in the 1924-1926 Report," where pot immersion cisterns were introduced. As these cisterns were only capable of holding 20,000 pots, the remaining 10,000 odd of the year were hand watered, as conducted before the introduction of the cisterns.

The Report for 1927-1928 opens with the statement of the resignation of the Director, Professor D'ALBUQUERQUE, who had been connected with the sugar work in Barbados for 38 years; also with that of L. C. C. LIEBENBERG. C. C. SKEETE, the Assistant Director took over the Director's work while that of LIEBENBERG devolved on Field Assistant S. H. EVELYN. There was thus a considerable shortage in staff; but there appears to have been no lack of interest and energy in the new cane breeding campaign, on which the Agricultural Department has concentrated its attention.

The year was one specially favourable for flowering of the canes, one arrow appearing as early as August 17th on Ba 11569 in St. Peter's parish. In Barbados the earliest arrows are specially valuable for seed purposes because of a leaf sheath rot or arrow sheath rot, as yet not certainly defined except that it is different from the common red spot of the leaf sheath (Cercospora). Almost all varieties suffer from it, but B 606, B 391, and B 381 appear to be specially susceptible. The maximum infection occurs in late November-December; so it was arranged, in the year under report, that all the apparatus should be in working order before November 1st. The programme of work is divided up into four sections: (*A*) Night observations on the time of flowering and dehiscence of the anthers: field variation in different canes: laboratory studies of the male and female properties. (*B*) Lantern Work. (*C*) Basket work. (*D*) Open crossing.

Following the practice first introduced by LIEBENBERG in November, 1926, night observations were made again with the view of obtaining fuller data on flower opening and anther dehiscence. The procedure was as follows. Five arrows of each variety to be studied were marked in the morning, but of these only such were studied as showed their first open flowers during the next night. Starting at 10-30 p.m., these arrows were examined by electric torch and hand lens at frequent intervals until the first flowers opened, after which the dehiscence of the anthers was similarly sought for. Then the time of cessation in flower opening was determined, and the time of maximum dehiscence, the former observation being checked by tying red wool immediately below the latest open flower observed. This all-night work must have been very trying, although the writer of the report does not stress the fact that more than half the nights were rainy: and tropical showers may be very heavy.

It was observed that the relative humidity and temperature of the air had a great effect on both flower opening and anther dehiscence. For instance, with high humidity and low temperature, the flowers of BH 10 (12) opened around 11 to 11-30 p.m., while dehiscence did not occur till 5 to 5-30 a.m., whereas in drier, warmer air, flower opening did not begin till 12-30 a.m. and the anthers opened within an hour. Wind also had an influence, especially with the same variety, in drying the anthers, as in the case last mentioned. Ba 11569 in high humidity and low temperature did not start opening its flowers before 12-30 a.m. and anther dehiscence did not commence before 7-15 a.m. But B 381 showed a remarkable variation : the flowers opened at 12 o'clock and the stigmas protruded above the paleae, but the anthers did not emerge till 24 hours later, when they immediately shed their pollen : if this prove to be a constant feature crossing this variety should be an easy task. As to the cessation of flower opening, little variation was noted, few opening after 6 a.m., while dehiscence appears to reach its maximum at about 8-30 a.m. A slip note is added that the flowering habits observed, summarized on a Table for eight varieties, are not supported by further observations ; so that further work is needed and we are left in doubt as to which of the observations are inconstant. The general humidity during the working hours is referred to as very great, and it may be that it was unusually so during the season reported on. LIEBENBERG obtained very different results in the previous year (when we gather that there was a drought) but all his observations were made on lantern arrows.

The relative fertility of the pollen was judged by the usual Java practice of staining the pollen with iodine : where starch was present fertility was assumed. Female fertility was presumably judged by actual performance. A Table is presented of the results of this study for 13 varieties, giving the extent and earliness of arrowing, nature of ovules, and amount and nature of the pollen. While this scheme provides a good rough and ready means of judging the general health of the pollen, a good deal more work should be devoted to its study, before its physiology can be considered as being understood ; the way for this study appears to have been opened, now that its normal germination has been accomplished.[1] It is observed by EVELYN that many insects were seen visiting the cane arrows, whose feet and abdomens were found covered with pollen. Honey bees appeared to prefer the flowers of Sealy Seedling and B 391, and " between 6-30 and 8 a.m. as many as a dozen could be seen on almost every tassel of the latter. Jassids were also noted on B 67, thrips on B 391, and ants on B 606. These observations suggest that insect pollination probably occurs in the sugar cane."

Lantern Work.—For cage work 40 lanterns were erected (and a good picture in the Report shows their substantial character) ; 30 of these were used for selfing and 10 for crossing. In all of them the first and last appearance of the arrows were noted and the first and last opening of flowers, and notes were taken as to the presence of sheath disease and moth borer. In selfing, the only operation was to tap the arrow smartly at 8-30 a.m. to assist in releasing the pollen. The results are given in a Table. No seedlings were obtained from Ba 11569, B 606, B 417, B 381, and almost none in B 391 and B 67 : few seedlings in Ba 8069, Ba 6032 and B 374 ; and 400-500 seedlings in BH 10 (12).

Seven varieties were used in crossing. Five of these were mothers, Ba 11569, Ba 6032, BH 10 (12), B 417 and Uba, and five were fathers, the

[1] *I.S.J.*, 1929, page 256.

middle three of those mentioned together with B 391 and B 374. The main characters leading to the choice of these seven are given in a Table : tonnage, sucrose content, ratooning power and resistance to mosaic. The treatment of the arrows in the lanterns was as follows. From 12-30 a.m. onwards, the stalk of each was tapped every half hour, by holding it firmly and striking it sharply immediately below the point of holding. This method proved very effective in causing the anther sacs to drop without opening, and there was no damage done to the stigmas nor dehiscence in the anthers remaining attached. Between 8 a.m. and 8-30 two arrows of the proposed father were introduced into the lantern and shaken over the partially emasculated mother arrow. The pollen dust was easily seen, and, if considered insufficient, additional male arrows were used. The results obtained on sowing these arrows are given in a Table. In this it is seen that in certain varieties a good number of seedlings were obtained where selfing gave none ; Ba 11569 gave over 1000 when crossed either with B 391 or BH 10 (12), while in other varieties considerable increases were noticeable, expecially in BH 10 (12) and Ba 6032.

Cane Basket work.—At the first visible signs of approaching arrowing, the stalks were selected and marked. Baskets were fixed round these stalks at about two feet from the ground and, when they were filled with soil, wires were wound round them and attached to the solid cane above and to the other canes in the same clump, to relieve the pressure and minimize the risk of breakage. One hundred of these baskets were installed during the season, and these were watered twice daily till the time for removal. Daily examinations revealed the first external signs of rooting, in the emergence of the root tips through the sacking ; and when the arrow began to emerge the stalks were severed, about six inches below the basal board of the basket. Later, the protruding piece was cut off and the whole mass, basket and all, was placed in a half barrel and soil added. Thirty of these half barrels were placed in the conservatory and thirty in free air under partial shade. The remainder were placed in pails of water, and the water was changed each day.

Crossing was effected by placing the proposed parents in adjoining barrels, and as the first flowers opened the arrows were tied together, the male somewhat higher than the female. Every day the male arrow was tapped to encourage the fall and distribution of the pollen. For various reasons only 25 per cent. of the arrows treated were ultimately sown, and a Table gives the resulting germinations from these 25. The programme was curtailed because of other work and shortage of staff, but 17 arrows produced 7395 seedlings which was considered very gratifying. A series of Tables follow with various details of each of the 100 shoots treated, including date of basketing, first signs of roots, first and last appearance of arrows and opening flowers, and general remarks, such as "normal," "broken by wind," "discarded," "rat-eaten," "tassel sheath rot," "moth borer."

Open crossing was tested on a very small scale, principally because of its being the favourite method employed in Java. Three arrows of Ba 11569 were selected and surrounded with arrows of BH 10 (12) and Ba 6032, and several hundred seedlings germinated in each case.

A note is added here by the writer of the report on a method of raising arrows, for such work as that described, from sets planted in barrels instead of in the field and later transferring these. His aims were (1) to determine whether arrows could be obtained in this way[1] and (2) to study the whole

[1] The growing of cane sets to the flowering stage in small pots is not unknown, so that raising arrows in barrels should be an easy matter. Confinement of space should certainly help matters. See *Mem. Dept. Agr. India, Botanical Series*, VIII, 3, July 1916, page 138.

question of arrowing and be able to apply stimuli experimentally. Sixty full sized cement barrels were used and sets planted in them, ten barrels at a time at intervals of two months, between December, 1926, and October, 1927. Cuttings of Ba 11569, a flowering variety, and of B 67 which rarely flowers, were chosen for the experiment. The manurial treatment was that in ordinary estate practice, and for the first few months the barrels were watered daily. Arrows were produced from the first three plantings as follows : 10 from ten barrels after 10 months, 14 after 8 months, and one when only six months old. Four barrels planted with B 67 gave seven arrows between them. The germination results are stated to have shown that five arrows from barrelled canes yielded 4563 seedlings indicating " that the arrows were normal and could be used successfully for hybridizing work." In his concluding remarks, the author summarizes the methods hitherto employed for isolating arrows in breeding work, namely, the Hawaiian method of using a solution of sulphurous acid, the Indian method of rooting the cane below the arrow, the Barbados variant described under basket work, and lastly the later practice in Hawaii of using sections of motor tyres for growing the arrowing shoots in nutrient solutions. These methods he considers laborious and difficult, and as requiring careful and accurate work by trained men, whereas the barrel method gives the desired results with a minimum chance of failure, and can be carried out from start to finish by ordinary field labour.

C. A. B.

The Sugar Trade of India during the Year 1927-28.[1]

Gur.—The net production of gur and jaggery, both cane and palm, in India, including the Indian States, during the season 1926-27 amounted to 3,069,000 tons,[2] while the estimated production of gur or raw sugar during the 1927-28 season was placed at 3,041,000 tons. Imports of gur or jaggery are negligible, not exceeding 500 tons on the average per season, while exports consisted of 2135 tons of jaggery to overseas destinations, mostly to Ceylon, and 4200 tons, mostly gur, to countries situated on India's borders.

Sugar.—The production of sugar by modern factories and refineries in 1926-27 amounted to 121,026 tons as compared with 91,400 tons in 1925-26 and 67,400 tons in 1924-25. Out of this 62,941 tons were made direct from cane in modern mills, and 58,085 tons from refining gur or raw sugar as against 52,995 tons and 38,409 tons respectively in 1925-26.

It will be seen that the quantity of sugar refined from gur in 1926-27 shows roughly an increase of 50 per cent. over last year. This is due to the fact that some of the factories making sugar direct from cane also worked as refineries during the off season with a view to reduce their silent overhead charges. The average price of refining gur in January, 1927, was Rs. 5 per maund at Cawnpore and the average price of Java white sugar and Indian factory made sugar from gur, viz., Cawnpore special sugar, in the same market was Rs. 13-14-0 and Rs. 13-1-0 per maund. The margin then appeared sufficient to make gur refining profitable. But as the prices of sugar declined during the year many of the refineries must have found this business hardly remunerative if not actually unprofitable. The truth is that, generally speaking, gur is an unsatisfactory raw material for refining and its price in India

1 Summarized from the "Review of the Sugar Trade in India during the Official Year, 1927-1928," by WYNNE SAYER, Secretary of the Sugar Bureau, Pusa.

2 Calculated according to the method employed by the Indian Sugar Committee in their report.

unlike Cuban raws or Java browns bears no true relation to the world price of sugar. It follows therefore that the process of refining gur frequently turns out to be a gamble. It would be far better in the interests of the sugar industry as well as the consumers of sugar if the import duty on raw sugar were graded as in the United Kingdom, so as to leave a refiners' margin of profit. Cane sugar factories should then be able to refine raw sugar in the off season and thus reduce their cost of production over the whole working season; capital would feel safe in sugar investment and the waste going on at present in gur making will be reduced by more cane going direct to the factory. If India could import sugar from any part of the world where it was cheapest and refine it at a profit, she would no longer be dependent upon a particular market for her supplies and her consumers would be safeguarded against victimization by any supplying country.

The following figures of India's sugar production will show what slow progress she is making at present :—

PRODUCTION OF SUGAR.

Year.	Direct from Cane.	Refined from Gur.	Total Maunds.*
1919-20	628,920	1,211,274	1,840,194
1920-21	669,291	1,324,646	1,993,937
1921-22	753,638	1,303,433	2,057,071
1922-23	651,415	1,368,126	2,019,541
1923-24	1,044,856	1,538,304	2,583,160
1924-25	921,950	916,121	1,838,071
1925-26	1,445,061	1,047,420	2,492,481
1926-27	1,716,426	1,583,997	3,300,423

* 1 Maund = 82$\frac{2}{7}$ lbs.

Taking India's production of deshi sugar[1] by the indigenous process and the improved khandsari process at 50,000 tons we arrive at a total production of 171,026 tons in 1926-27 as against 141,400 tons in 1925-26.

Imports of Foreign Sugar.—India's imports of foreign sugar during the year 1927-28 totalled 725,800 tons, as against 826,900 tons in 1926-27, 732,600 tons in 1925-26, 671,000 tons in 1924-25, and 411,500 tons in 1923-24. These figures are for British India only and do not include imports into the Indian States, which it is understood took 68,000 tons in 1927-28. Stocks at the beginning of the year were heavy and importers followed a hand-to-mouth policy. The decline in imports was at the expense of beet sugar, while the imports of cane sugar actually increased as a result of low prices. Imports during the year from Java of sugar 16 D.S. and above, including consignments from the Straits Settlements, rose to 693,200 tons, as compared with 612,500 tons in 1926-27. Imports from the United Kingdom fell to 366 tons. American supplies dwindled to almost nothing, whereas in the preceding year the U.S. had sent 11,600 tons to India. As regards beet sugar, the total quantity imported during the year was 18,000 tons, as compared with 176,000 tons in 1926-27, of which Russia supplied 11,900 tons. Imports from Czecho-Slovakia fell from 28,800 tons in 1926-27 to 1100 tons in 1927-28.

Consumption.— The consumption or rather distribution of sugar during the year 1927-28 amounted to 951,499 tons, as against 900,000 tons in 1926-27.

The Outlook.—Mr. SAYER in summing up the sugar situation has the following remarks on the effect on India of Java's and Cuba's policy of over-production. "Forecasts for 1928-29 point to a further increase of over a million and a quarter tons in the world's production; where, we may ask, is it all leading? Already the surplus in Java has forced the V.J.P. into a

[1] White Sugar made by local methods.

policy of storing sugar at the mills followed by a price reduction 'West of Suez' which has created intense dissatisfaction in India, which is Java's best customer. These tactics, while they may have the effect of placing the crop in strong second hands and thus forcing up the price, must by the very act of price raising open the door to B.R.B. and continental beet in India. The United Kingdom market is now closed for continental refined as a result of the revision of the import duties in April, 1928, and thus affords a further stimulus for this stream of sugar to find an outlet in the East. Over all looms Cuba. She has already as a result of her efforts at limitation on a solo basis 'held the baby' for the world and it would appear that a policy of handing the trouble as rapidly as possible to other holders at all costs is now to be pursued. What this means, coupled with Java's steady progress, is best visualized by realising that some two million tons of sugar will shortly be stalking the earth looking for some one to devour them and that this two millions will be over and above the normal consumption and carry-over in the average year. *To obtain a market this sugar will have to assume any form and invade any market where it will sell best.* It will assuredly come East in some shape or form, for the whole of Europe is busily engaged in building up tariff walls against other people's sugar and besides, its appearance in the East will give Java a taste of what Cuba has already had to swallow. The three main Eastern markets available are China, Japan and British India. China may be ruled out for absorbing any appreciable quantity out of Java's surplus. Japan is already well on the way to become self-supporting and possesses an intelligent Government who are quick to utilize their tariff if they see trouble ahead for any home industry. This leaves British India as the only remaining avenue. She consumes over a million tons of imported whites already, and further makes and consumes some three million tons of gur. Leaving the white sugar market alone where Java is a strong competitor, to swamp the gur market is merely a question of price, for all the old economic shelters of the gur industry have vanished, communications and caste prejudices no longer stand where they did, and all the outside world can see is a market for three million tons of sweet stuff at present held by one of the most inefficient industries in the world, to compete with which on a price basis is child's play. Once foreign gur or low grade sugar really enters the Indian market, the Indian cane crop, except in the white sugar tract must vanish, for nothing on earth can help to bolster up the present inefficiency of gur making against an efficient outside competitor, and the ryot will be left without a money crop in many places and the problem of agricultural finance will be further complicated. Salvation lies along the path by which the Japanese have made their industry in Formosa—failing that, India must fall back into the position of the world's largest helpless consumer, a sad position for a country which was but a short time ago the largest cane grower in the world."

SUGAR FALLACIES.—Dr. Woods Hutchinson recently contributed to the press[1] a popular article in which the prevalent belief that it should be avoided by those desirous of cultivating slender figures was exposed. "Sugar is a food prepared to be burned, not for storage. Its real danger to our waist-lines is that a small amount of it will make so tasty large amounts of high-voltage foods, such as bread and cereals, that we may be tempted to devour more of them than we can use at once, and thus begin to pile up to reserve adipose that is so disturbing to our contours." Sugar is the quickest stimulant there is, and is not a narcotic like alcohol. It is a valuable emergency ration. And sugar in itself never affects clean healthy teeth, this authority stated.

[1] In the *Ladies Home Journal.*

League of Nations Enquiry on Sugar.

I.—Dr. Geerligs' Report on the Production of Cane Sugar.

At its 26th session last October the Economic Committee of the League of Nations decided to apply to certain sugar experts of world-wide reputation to prepare for them memoranda on certain specific aspects of the problem. Below we give a summary of, and extracts from, the Note prepared by Dr. PRINSEN GEERLIGS on the Production of Cane Sugar.[1]

After a preliminary survey of the conditions of production, in the course of which he outlined the geographical limits, the climatic factors, including the incidence of drought, hurricanes, etc., the varying periods of crop growth, the conditions of labour, and finally the differing types of sugar produced, Dr. GEERLIGS went on to deal with the problem of estimating costs of production in the different producing countries. He cited a previous attempt that had been made, viz., by the American Tariff Commission in 1923, which body went thoroughly into the question in all its bearings; but, as President COOLIDGE's reply to the Commission's findings clearly bore out, this Government Commission with full authority was unable after a searching investigation into costs of production in certain well administered countries, to arrive at a result from which any conclusion of value could be drawn.

"If an official commission (to quote Dr. GEERLIGS) carrying on its investigations with the utmost zeal, can produce no better result than this, it is certainly not possible for much less excellently equipped enquirers to obtain an accurate idea of the cost of production of cane sugar in countries where they must depend for their information on the goodwill of the manufacturers, or where the latter have themselves no knowledge of the true state of affairs. On this point, MAXWELL remarks on page 92 of his book[2]: 'Reliable data relating to costs of production in the cane sugar industry are, generally speaking, not readily available. Indeed, in certain quarters, an attempt at obtaining such figures is invariably met at the best with a polite rebuff.' This may be so, but in the majority of cases the manufacturer himself does not know what should and what should not be included in the cost of production, so that a 'polite rebuff' is often due to pure ignorance and not to secretiveness.

"To take a few instances: should interest on initial capital and working capital be included in cost of production or not? Should depreciation of plant and premises be included or not? If so, up to what percentage of original cost? Should rates and taxes—when they are not levied expressly in return for services rendered by the authorities, but when their yield is used to help and promote industry, e.g., for irrigation, railways, canals, etc.—be included in cost of production or not? Should profits from by-products and accessory profits be deducted from cost of production? We are faced, therefore, by a number of questions which would need the knowledge and experience of a first-rate accountant, who would, moreover, have to be thoroughly acquainted with the special circumstances under which each firm works. Consequently, it is not surprising that manufacturers should receive a request for particulars of costs of production with a 'polite rebuff.'

---

[1] Taken from "Sugar: Memoranda prepared for the Economic Committee by Dr. H. C. PRINSEN GEERLIGS, Messrs. F. O. LICHT, and Dr. GUSTAV MIKUSCH." League of Nations Publications, II, Economic and Financial, 1929 II, 20. (Constable & Co. Ltd., 10 Orange Street, London, W.C. 2).

[2] Francis Maxwell, D.Sc., M.I.Mech.E., F.C.S.: "Economic Aspects of Cane Sugar Production." London, E.C.3, Norman Rodger, 1927.

" Accordingly, it is the business of the enquirer to sort the replies out in the light of local circumstances, so that similar cases are grouped separately from other groups of similar cases of a different kind. Owing to the great diversity of conditions in the cane sugar industry in different countries, this is an extremely difficult task. Moreover, even if accurate figures could be compiled for cost of production in all the factories in one country, these figures would vary so greatly for different firms that it would be quite unfair to take the arithmetic mean of the figures in question as representing the average cost of production of sugar in that country.

"If there are two works, *A* and *B*, in the same country, and owing to better soil or other factors *A* produces half as much sugar again as *B* on the same area and at about the same cost, and consequently produces its sugar for 2 cents a lb. while *B*'s sugar costs 2·70 cents, then the average cost of production will be 2·35 cents. If, however, the selling price is 2·50 cents, then by a simple calculation *B* makes a profit of 0·15 cents per lb., whereas in actual fact it makes a loss of 0·20 cents. These discrepancies are considerable enough in any comparison between concerns working under approximately similar conditions ; when, however, we compare firms, or even averages of firms, in different regions or producing countries, the variations become wider. A few instances will suffice.

" In Java and Hawaii, nearly all the cane used is planted, harvested, transported and worked up by sugar manufacturers under their own direction and for their own account. The sugar is extracted from the juice of the cane, packed, sold and transported to harbour, all under their own direction. There are no by-products of any importance : all residues (bagasse) are consumed in the furnaces, and the profit from the sale of molasses is negligible. Once it is agreed which items of expenditure are to be reckoned as capital expenditure and which as working expenses, we can note down all items of the latter class, add them up, and divide them by the weight of sugar extracted, thus obtaining the exact cost price per lb. of sugar of the kind extracted. It will be seen that the cost price is affected only by the permanent factors—output of cane and sugar—and not by the price of sugar, though in Hawaii the work-people permanently employed receive a bonus if the price of sugar at New York rises above a certain point, so that the price of sugar is not entirely without influence on costs. In Java, bonuses depend on profits and consequently do not increase the actual cost of production.

" In certain of the British West Indies and in Egypt, the manufacturers buy, in addition to their own crops, cane from tenant planters at a fixed price, based on the weight of cane delivered, irrespective of the sugar content. They also work up the cane and treat the sugar as stated above. Here, therefore, the output of cane per unit of area is of no importance, while the sugar content is a serious factor. Here also the cost of production is independent of the market price of sugar.

" In Natal, Queensland and Demerara, the manufacturers buy the cane by weight and sugar content and work up the sugar as described above. In these cases, again, the factor of the sugar content of the cane ceases to operate, since the manufacturer only buys the actual amount of sugar in the cane irrespective of whether it was grown on a large or small area. The market price of sugar is of no importance here.

" In Cuba, the Philippines, Porto Rico, Réunion and Mauritius, the manufacturers buy, in addition to what they have planted themselves, cane from tenants or independent planters in return for from 5 to 7 per cent. of the weight of sugar in the cane, or its equivalent in cash, at the market price on day of

delivery of the cane, or at the average market price during a fixed period. The cost of production in these cases is not influenced by the output of cane per unit of area, but by the sugar content of the cane, and in particular by the market price of sugar. If in any one year the sugar should sell at twice as high a price as in any other year, then in the former year the item "raw material" in the calculation of cost of production must also be twice as high as in the other year, although it is quite possible that, in point of fact, the cost of producing the cane was the same. The charges connected with the transport and working-up of the cane and the preparation, packing, sale and despatch of the sugar, remain unchanged if the sugar content of the cane is also unchanged, and consequently the proportion of the cost of production represented by the raw material varies very widely from one year to another."

Other complications cited by Dr. GEERLIGS are the difficulties occasioned by attempting to calculate costs where the product turned out (raw or white sugar) is not the same as at other factories or in other districts; where the by-products are variously disposed of, being either thrown away or used for production of rum or alcohol, and where the bagasse is alternately used as fuel or as the basis of a building material. In short, concludes Dr. GEERLIGS, there is such a wide variety of factors influencing the cost of production of sugar that it is clearly impossible to give figures capable of comparison. He furnishes the Economic Committee with a number of examples culled from various sources, which may be taken as merely illustrating how costs of production are calculated, but he avers that these do not in the least represent an average cost of production for a whole country or a whole region over a number of years.

As regards Cuba, Hawaii, Porto Rico and Louisiana, Dr. GEERLIGS quotes the figures of the American Tariff Commission above referred to (see *I.S.J.*, 1924, page 3, for the net cost figures). These show that as regards Cuba the 1921 crop averaged 3·975 cents per lb. in cost of production, that of 1922, 2·146 cents, and that of 1923, 3·67 cents, these differences being due to the sale price of cane varying in accord with the market price of sugar. Actually in 1922, some 36 per cent. of the Cuban factories produced their sugar at 2 cents per lb. or less, and 57 per cent. at from 2 to 3 cents or less. As regards the other countries, 3 per cent. of the Porto Rico factories produced sugar at 3 cents, while 50 per cent. of the Hawaiian output, 35 per cent. of that of Porto Rico, and 85 per cent. of that of Louisiana cost from 4 to 6 cents or even more.

Other costs of production are quoted or calculated by Dr. GEERLIGS as follows :—

Philippines : Cost price c.i.f., New York, 3·06 to 3·20 cents.

Java : In 1925 gross cost was 2·82 cents, net cost 2·24 cents per lb. In 1926 the gross cost was 2·47 cents. Two factories selected at random, one producing white, and the other raw sugar, returned their costs as 2·34 cents for the white sugar factory and 2·72 cents. for the raw sugar one. These include carriage and depreciation.

Queensland : MAXWELL's work on Economic Aspects quotes the cost of production in Queensland as about £25 per ton,, but allows nothing for interest, depreciation, and carriage of sugar, These should amount to £3 per ton, so that the cost per ton is nearer £28, or 6·60 cents per lb.

League of Nations Enquiry on Sugar.

Statistics of Production of Cane Sugar.

Dr. Geerligs next deals with the problem of estimating production of sugar per unit of area, which in most cases is not too easy to ascertain for any one year. The reasons for this are various and include : the difficulty of ascertaining the actual area in many countries where small planters do not make returns of their areas under cane to a central institution ; the fact in some cases that the whole planting is not harvested in one year ; the point whether newly planted cane or ratoons are grown ; the fact that in many places not all the cane harvested is made into sugar—the main product may be cattle food, sweetmeat, syrup, rum, or alcohol ; and finally the very wide differences in the quality of the sugar obtained.

Mr. Rudolf E. Grotkass, remarks Dr. Geerligs, attempted a comparison of unit production in the *International Sugar Journal* (1927, 467) but limited it to the period of growth and ignored all the other factors which influence the result. After reproducing Mr. Grotkass's figures from that article referred to, Dr. Geerligs comments as follows : " So far Mr. Grotkass. He somewhat arbitrarily halves the official figures for Hawaii and Peru, while leaving others which need revision for the same reasons unchanged. Nor does he take into consideration the other factors which may influence the comparability of his figures. He arrives at figures for output per hectare ranging from 1·51 tons in Brazil to 13·71 in Java, which latter figure had already risen to nearly 15 in 1927-28. In any case, his figures show what wide differences are at present to be found between the yield in different producing countries, how the production of sugar per hectare is generally on the increase, but also how much room there still is for improvement in many countries."

Dr. Geerligs on his part submits a few production figures for countries of which " we can judge fairly well of their accuracy." The following is a summary of his data, which refer to *metric tons per hectare.*

India : In the five years to 1929 production was 2·66 metric tons.

Formosa : 3·33 tons in 1922 and 6·05 tons in 1927.

Philippines : In 1923 newly planted cane yielded an average of 6 tons of sugar per hectare. For a number of concerns in Negros the yields averaged 3·8 tons.

Java : Java has risen from 10·2 tons in 1913 to 15 tons in 1928.

Louisiana : In 1927-28 the average was 2·11 tons.

Cuba : Assuming a yield of about 11 per cent., an average of 5 tons.

San Domingo : At 10 per cent. yield, an average of 6 tons.

Porto Rico : At 10 per cent. yield, 6·7 tons.

Peru : For the last ten years output of sugar per area harvested has varied between 10·3 and 11·7 tons.

Argentina : In 1927 the yield was 2·73 tons.

Mauritius : With a yield of 10·5 per cent., 4·75 tons per hectare.

Queensland : In last 13 years, output has varied between 4·78 and 6·08 tons per hectare harvested.

Hawaii : 14·3 tons of sugar per hectare harvested.

Future Prospects.

As for future prospects, Dr. Geerligs remarks that it has been frequently stated that Cuba or Java or Formosa had reached its peak of production, but in every case the assertion proved wrong. It is therefore better not to offer any forecast on those lines.

The possibility of unlimited expansion for some time to come cannot be regarded as wholly non-existent. In Cuba, Argentina, India, the Philippines, Queensland, Natal, China, Africa, Brazil, and elsewhere, plenty of land suitable for cane growing is still available. In many countries the sugar yield per unit of area is still so much lower than it might be that an immense increase could be secured by improving the variety of cane, planting equipment, methods of cultivation, manuring, manufacture, etc. If in a country like Java it is possible in the space of a few years to increase by 30 per cent. the sugar yield of a given area, the potentialities of countries where efficiency is not yet so high are incalculable.

2.—Consultation of Experts on Beet Sugar Production.

The Delegation of the Economic Committee, enquiring whether International action would be desirable and feasible with a view to remedying or mitigating the depression in the sugar industry, consulted experts on beet-growing on May 13th and 14th.

The experts had been informed of the results of the sugar enquiry held at the beginning of April. The International Institute of Agriculture had moreover, in view of this consultation, prepared a memorandum on beet-growing, emphasizing the advisability of not considering beet-growing merely from the point of view of the requirements of the sugar industry, but of taking account of the fact that one of the effects of beet-growing is considerably to enhance the productive capacity of agriculture.

The experts were first invited to describe the position as regards beet-growing from the point of view of their respective countries. They gave information bearing on the general organization of the sugar industry (more particularly, the relationship between farmers, factory owners and refiners), the extent to which increase in output or decline in demand had affected prices and rendered production unremunerative; factors affecting beet-growing, such as recent scientific discoveries, tariffs, subsidies and other government measures, wages and prices ; the prospects of an increase in production and the influence of prices and government action on consumption.

The experts laid particular emphasis on the effect of the depression in the sugar industry on the agricultural situation in the principal European countries in view of the bearing of beet growing on agriculture. This industry must be considered from two points of view ; on the one hand, it ensures the existence of numerous agriculturists ; on the other hand, it plays a considerable part in crop rotation and in cattle breeding. The European beet and sugar production does not at present exceed the pre-war standard and, in the opinion of the experts, cannot be considered as responsible for the general depression in the sugar industry. Beet producers consequently do not consider that, in the present circumstances, measures to reduce production would be desirable or even feasible. Although the consumption of sugar has increased more in Europe than anywhere else, producers would be willing to assist in any action for increasing world consumption whatever form that action might take. They further consider that no action would have any chance of success without the close co-operation of beet-growers and the sugar industry.

Certain experts said that they would be prepared to take part in an International action for applying an immediate remedy to the sugar depression, which would take the form of rationing the exports from countries whose production exceeds their own requirements, pending such development of world consumption as would make it possible to absorb the normal surplus of

exporting countries. They, nevertheless, recognized the practical difficulties of such an action which, in their opinion, should not be conducted by the governments.

Various questions were then put to the experts. They bore upon the possibility of replacing the beet by other crops without detriment to the general agricultural position ; on a possible improvement of beet production ; on the possibility of using the beet roots as cattle fodder ; on the use of denatured sugar ; on the possibility of developing cane sugar production ; on measures for increasing consumption ; on the effect of a decrease in the tax on consumption ; on the possible effect of beet production and on the desirability of League action in regard to the sugar industry.

The replies showed that there was some difference of opinion. Several of the experts, but not the majority, were more or less in favour of replacing the beetroot by other crops. The development of cane sugar production was generally regarded as a serious menace for beet production ; on the other hand, the opinion of the minority was that protectionist measures in favour of beet production constituted a greater danger. A decrease of consumption duties on sugar was generally recommended, but one of the experts thought that such a decrease should be accompanied by a reduction of customs duties.

The Delegation of the Economic Committee was composed of M. TRENDELENBURG (President), Sir SYDNEY CHAPMAN (Vice-President), and MM. BRUNET, NEDERBRAGT and STUCKI, assisted by MM. ASHER HOBSON and GEORGES RAY, representing the International Institute of Agriculture.

The following were the experts consulted :—

Germany	OBERAMTMANN WENTZEL.
Great Britain	Sir DANIEL HALL, of the Board of Agriculture.
Belgium	M. MULLIE, Senator, Agriculturist.
Denmark	M. PETERSEN, Chairman of the International Association for Seed Tests, Copenhagen.
France	M. MOMMIREL, Chairman of the *Confédération générale des Planteurs de Betteraves.*
Netherlands	M. MINDERHOUD, Professor at the University of Agriculture.
Hungary	M. SERBAN, Secretary-General of the Hungarian National Chamber of Agriculture.
Italy	M. DE VECCHI, of the Fascist National Agricultural Federation.
Poland	M. HUMNICKI, Chairman of the Federation of Beet Seed Planters.
Rumania	M. FILIPESCU, Inspector-General, Agricultural Engineer.
S.C.S. Kingdom ..	M. JOURITCH, of the School of Agriculture.
Czechoslovakia ..	M. ERDLIK, Former Minister of Agriculture.

CANES IN JAVA.—POJ 2878 was planted in Java in 1926 only to the extent of ¾ per cent., in 1927 the plantings was 12½ per cent., in 1928, 66½ per cent., whilst the figure for 1929 is given as 93 per cent. This latter will cover 172,971 hectares.[1]

BRIGG BEET FACTORY'S REFINING OPERATIONS.—It is reported that Brigg Beet Factory in its present off-season is dealing with a purchase of 5000 tons of Cuban raws and hopes to refine 400 tons a day, working the factory on a three-shift system.

A SUGAR VETERAN.—The death is announced of one of America's best known and most widely travelled sugar engineers in the person of Dr. John B. Aroix, who has been associated for the past quarter of a century with the firm of George L. Squier Mfg. Co. of Buffalo. Born in France, he migrated to America in his early twenties and started his career in the sugar industry in Cuba. After he became associated with the Buffalo firm, he travelled South American sugar districts for many years and was well known on that Continent, especially in Brazil.

1 *Archief*, deel III, 1929, No. 9.

South African Sugar Technologists' Association.

Papers read at the Annual Congress.

At the Annual Congress of the South African Sugar Technologists' Association, held at the end of March of this year, at Durban, several useful papers were read and discussed.[1] We give below a summary of these

Chemical Control.—The Committee on Standardization of Chemical Control dealt with a number of points, the more important of which are the following. They recommended that account should be taken of "cane-chaff," which is defined as that portion of the field refuse which is removed from the cane between weighing and crushing, this making the weight of bagasse as the weight of the cane plus that of the maceration water, less that of the mixed juice, less that of the cane-chaff when weighed. "Last pre-maceration juice" is the last juice expressed from the mills before the application of maceration. "Natal sucrose" is the purity of the first crusher juice multiplied by the Brix of the *L.P.M.* juice (last pre-maceration juice) divided by 100. And the "Natal ratio" is the sucrose per cent. cane, divided by the Natal sucrose, then multiplied by 100. It was decided to adopt the available lime test of the Hawaiian S. T. Association; and also the soap test to the determination of calcium salts in clarified juice. It is considered that further work should be done on methods of testing for SO_2 in sugars. It is also recommended that in factory laboratory reports, the following should be given: lime used in the factory; calcium salts, ash and turbidity (using Kopke turbidimeter); massecuites in cub. ft. per ton; and the SO_2 in sulphited juice, syrup, massecuites and sugars, expressed in parts per million, instead of mgrms. per litre.

Laboratory Reports.—In 1928 there were 25 factories in operation in South Africa, but only 14 of these compiled and returned chemical control reports to the Association. Owing to drought, it was difficult last year to compare the performances of factories. No. 1 factory, however, although within the very drought-stricken Inanda division, still managed to maintain its lead in over-all recovery (78·40) by virtue of its high extraction (93·72), although surpassed by many factories in boiling-house recovery. This factory shows an average sucrose per cent. of bagasse for the season of only 2·79. No. 5 factory, after a slow beginning, due to difficulties connected with starting up a new plant, maintained from July onwards a crushing rate of 74 to 78 tons of cane per hour associated with an extraction up to the average and the only boiling-house efficiency of over 100. No. 6 factory, in the Zululand area, had an excellent season, being supplied with a quality of cane much above the average, and attained an over-all recovery of 78, only surpassed by factory No. 1. The ratio of the cane to sugar, 8·7, is the lowest recorded in Natal, showing the record figure of 8·0 for the September period. No. 7 factory again shows the highest boiling-house recovery for the season (87·03) and the highest Java ratio. Factories Nos. 8, 9 and 11, all within the South Coast area, show relatively low recoveries associated with the low juice purities of this drought-stricken district. One of these factories was also much hampered by an actual shortage of water for factory use.

Fibre Determination.—Last year the Committee outlined what seemed to be a possible method of determining fibre solely from the water content of the *L.P.M.* bagasse, but, as they felt too many doubtful factors were

[1] Reproduced in full in *S.A. Sugar Journal*, April 30th, 1929.

involved, they now recommend that either the cane or the last bagasse prior to maceration (*L.P.M.* bagasse) be used, the fibre being found directly after lixiviation and drying. In sampling cane 16 sticks should be taken at random from different points along the carrier from at least 75 per cent. of the consignment, taken to the laboratory, and each cut up into 4 lengths. These lengths are placed in four piles—all the tops in one pile, all the butts in another and so on. The 16 portions are chopped up into sections one inch long, well mixed in a basket or bucket, and a double handful passed through the shredder. A Hyatt reducer or a gallows cutter is recommended for this purpose, 100 grms. of the shredded cane being taken for testing. In sampling *L.P.M.* bagasse, portions should be taken by hand at regular intervals along the whole breadth of the carrier between the point where the bagasse leaves the mill and the point where maceration is applied. It should be placed in an air-tight container and sent immediately to the laboratory and a portion passed through the shredder. Then 100 grms. of the shredded cane or bagasse should be placed in a linen bag (50 per cent. larger than the sample), treated in a convenient form of lixiviator, and finally dried.

Natal Ratio.—It became apparent that the Java ratio method was open to a very serious objection whenever the cane was wet by rain, the water adhering to the surface of the cane being washed off by the juice to pass almost entirely into the first crusher juice. This, of course, raised the ratio, but the position could not be met entirely by adopting a daily instead of a weekly ratio as often the cane was wet for only part of a day. The result was that the sucrose per cent. for dry cane was too high at the expense of the wet cane. From a series of experiments initiated by Mr. G. S. MOBERLY at some of the larger factories, it became apparent that while wet cane caused a drop in Brix at the first crusher, the Brix at subsequent units was scarcely affected. In one experiment carried out at Empangeni, the cane was thoroughly wetted with a hose pipe on one side of the carrier while that on the other side remained dry. A number of Brix readings of juice from the wet and dry sides at the first and second crusher were taken. The average of these readings was as follows :—

	Dry Side	Wet Side
1st crusher	19·7	17·4
2nd crusher	19·6	19·5

It was, therefore, suggested that the ratio should be based on the 1st mill juice (or what was subsequently termed the last pre-maceration juice), instead of on the 1st crusher juice. However, it was still necessary to test the 1st crusher juice for purity in order to apply the Fahey scale of purity bonus and penalty. As the testing of both juices for sucrose would have involved a lot of extra work, it was suggested that the ratio should be based on the product, Brix of last pre-maceration juice × purity of 1st crusher juice. This product was named the "Natal sucrose" and the ratio based on it was named the "Natal ratio."

N.R. in practice.—The Natal ratio has been in operation for a whole season, but it is difficult to judge its effect, owing to 1928 being an exceptionally dry year. Some extraordinarily conflicting results were observed. In some cases the Brix of the *L.P.M.* juice remained steady during the wet weather and in other cases it dropped, and there were even cases where it rose. Day-to-day variation in the cane makes comparisons very difficult. Another disturbing factor is that some times rainfall is recorded from 6 a.m. to 6 a.m., whereas the mill day is from 6 p.m. to 6 p.m. In order to get some idea of the working of the Natal ratio as a whole, a number of rainy days at four

factories have been considered. Averages have been taken of two days before rain, the actual day or days of rain and the two days after rain, these being :—

	Brix.	1st Crusher Juice Sucrose.	Purity.	L.P.M. Juice Brix.
Before	21·10	18·74	88·81	20·75
During	20·62	18·22	88·36	20·64
After	20·78	18·44	88·74	20·60

Natal Sucrose	Java Ratio	Natal Ratio	Sucrose per cent. Cane By J.R.	By N.R.
18·43	75·88	76·77	14·22	14·15
18·24	77·18	77·30	14·06	14·10
18·28	76·62	76·09	14·13	14·07

From the above it is apparent that with the use of the Natal ratio there is a smaller decrease in the sucrose per cent. cane than when using the Java ratio, the decreases being 0·35 per cent. and 1·05 per cent. respectively. However, for the days following rain, with the Java ratio the percentages rise again, but continue to fall with the Natal ratio, due evidently to the fact that the water had been absorbed by the cane and caused a greater dilution in the *L.P.M.* juice than in the 1st crusher juice, due to the greater pressures of the *L.P.M.* crushing. Another point is the drop in purity during rain followed by a subsequent partial recovery. This bears out the results of tests made during the 1927 season, and causes a direct loss to planters from causes entirely outside their control.

Irrigating the Sugar Belt.—This was the last paper and was by Mr. E. HUDSON SPENCE giving the results of the possibilities of irrigation in the Natal sugar belt, the conclusions arrived at being the following : (1) The water supply is sufficient for a greatly increased production, estimated at some 270,000 tons of sugar. (2) To produce this quantity of sugar, an area of 45,000 to 270,000 acres of good land will be required. (3) Owing to the topography of the sugar belt, irrigation schemes will, generally speaking, be expensive. A reasonable capital investment on gravitation schemes would be £60·09 per ton of additional sugar produced by irrigation, or £300 per acre with a production of 5 tons of sugar per acre from irrigation. (4) On the other hand, owing to the excellent response which cane makes to irrigation, schemes for the irrigation of cane will bear the high capital and annual charges. (5) Further experiments are required to determine how Uba cane responds to the application of water with various types of soil, degrees of fertility, etc. In the discussion following, Mr. MASTERS said many planters might be afraid of the capital cost, round about £300 per acre. Certain soils could stand that, but from experience at Natal Estates he could say the capital cost would not be more than £50 per acre where water was available. 2·1 tons of sugar per acre from Uba cane was what they were getting at present, and Natal Estates were hoping to get that per annum, instead of every two years as at present, with the application of irrigation. From past experience they knew they could expect 24 to 25 tons of cane per acre where they were able to put on 15 in. of water. Natal Estates hoped to irrigate 5000 acres and also anticipated that their capital expenditure would not be more than £50 or £60 per acre. Probably the first costs would run up to £150 per acre, but when the whole scheme was completed he felt sure the costs would not exceed £60.

THE NATAL 1929 SUGAR CROP.—Unofficial advices from South Africa put the yield of the coming 1929 sugar crop in Natal at 315,000 short tons, as compared with 295,000 tons last year.

The 1928 Java Sugar Crop.

By R. J. PRINSEN GEERLIGS.

During 1928, 178 factories were active in Java. The sugar estates planted and harvested an area of 195,086 hectares (481,863 acres) against 184,462 hectares (455,806 acres) in 1927. The total amount of cane harvested was 25,295,079 tons[1]) or 52·53 tons to the acre. The total sugar crop amounted to 2,901,751 tons or 13,433 lbs. to the acre. The figures for the different Residencies and totals and averages in tons, lbs., acres, etc., as given below, are calculated after the data published in the *Archief voor de Java Suiker-industrie*).[2]

The 1928 season proved an extremely good one ; it had, as above stated, an average production of sugar to the acre of 13,433 lbs., which is the highest figure ever reached.

The monthly estimates of the production of the mills associated with the United Java Sugar Producers, which figures are expressed in tons, were as follows :—

Date.	Estimate. Tons.	Date.	Estimate. Tons.
15th March	2,327,993	31st August	2,657,897
30th April	2,356,617	30th September	2,676,133
31st May	2,460,497	31st October	2,677,397
30th June	2,587,495	Final result	2,677,192
31st July	2,635,464		

In 1928 the average tonnage of cane amounted to 52·53 tons to the acre. The Residency of Kedoe reported the largest figure (60·02 tons), followed by Soerakarta (55·16 tons), while Cheribon was lowest in this respect with only 49·75 tons of cane to the acre.

The sugar content of the cane was very good and gave an average sugar extraction of 11·45 per cent. The highest was attained in the Residency of Djokdjakarta with 12·34 and the lowest in that of Besoeki with 9·98 per cent.

The highest average yield of sugar to the acre is reported from the Residency of Madioen with 14,629 and the lowest in the Residency of Besoeki with 11,775 lbs. The maximum figure for one single factory was obtained in the Residency of Djokdjakarta, where Gondang Lipoero estate scored the greatest output of sugar to the acre with 19,635 lbs.

In studying the list of cane varieties planted, it will be seen that all varieties have decreased except the POJ canes ; in the case of POJ 2878 there has been a considerable increase.

The sugar crop amounted in all to 2,901,751 tons, of which 2,776,430 tons were first sugars and the balance consisted of after-products, calculated back to the equivalent of first runnings in ratio of 4 : 3. The figures in the second column of Table III refer, however, to the real weight. Besides the sugar, a quantity of 72,603 tons of solidified and one of 694,635 tons of liquid molasses were manufactured.

Table IV shows an increase in the proportion of the first runnings white plantation sugar ; a small amount of Muscovado has been manufactured, while the Refining Crystals of 98° polarization have decreased considerably.

The data now following, dealing with the figures for factory work, have been derived from the statistics issued annually by the Chemical Department of the Java Sugar Experimental Station, but whereas the foregoing figures referred to every one of the 178 factories, the technical data relate only to 175

1 Tons of 2240 lbs.

2 Mededeelingen van het Proefstation voor de Java Suikerindustrie, 1929, No. 8.

establishments, viz., those subscribing to the upkeep of the station. As these are the best controlled factories, it is probable that the figures, recording the work in them, are better than the total average of the 178 that worked in 1928, although it is not believed that the difference is large.

In addition to the list of averages we give here a few maxima and minima, relating to the results of the entire grinding season in the individual factories. We have not added the names, as these are unnecessary.

	Maximum. 1927.	Maximum. 1928.	Minimum. 1927.	Minimum. 1928.
Sucrose in cane	14·70	15·40	10·20	9·80
Fibre in cane	16·40	18·10	9·80	10·30
Sucrose in bagasse	5·10	5·40	1·40	1·50
Moisture in bagasse	53·30	52·30	39·60	39·60
Sucrose in filter-press mud (defecation)	10·90	10·50	0·80	0·70
Sucrose in filter-press mud (carbonation)	1·90	3·50	0·20	0·20
Purity of raw juice	87·30	88·70	75·50	74·30
Purity of final molasses	34·00	35·70	24·70	24·70
Sucrose in juice on 100 cane	14·34	14·60	9·27	9·27
Calculated available sugar on 100 cane	13·98	13·42	8·25	7·69
Sugar extracted on 100 cane	13·63	14·10	8·53	8·09

The sugar content of the cane was very good; the purity of the raw juice averaged 84·30. As the extraction of the juice by the mills was good, the amount of sugar extracted in juice on 100 cane was 12·70 per cent. on an average. Of the calculated available sugar, which was 12·45, actually 12·16 was extracted. The quotient of purity of the exhausted molasses was 30·10. In general, the work done in the sugar house was good, both in respect to the milling work and to the working up of the juice.

We also give below the data, relating to the total sales of Java sugars and the portion sold by the United Java Sugar Producers, which body, according to these figures, disposed of 90·9 per cent. of the total Java crop of the year 1928.

ASSORTMENTS.	TOTAL SALES TONS.	SALES BY U.J.S.P. TONS.
Superior "head" sugar	1,901,910	1,732,000
Superior soft sugar	10,010	7,000
Channel assortment, 98° pol.	764,565	736,000
Muscovado	102,588	101,000
Molasses sugar	163,112	101,000
Bag sugar	688	
Total Sales	2,942,873	2,677,000

The United Java Sugar Producers began their sales of the 1928 crop in the month of November 1926, with prices of 18 guilders per 100 kg. for the whites; this price increased and reached at 9th December, 1926, the height of 18·50 guilders. After that date no selling took place, till at 24th November, 1927, sugar was sold at the price of 16·50 guilders, which price declined during the following months at 13·50 guilders. The last parcels of the crop were sold at the price of 12·50 guilders per 100 kg., so that by December, 1928, the 1928 sugar crop was practically sold at the average price of 14·24 guilders per 100 kg. for the whites and 13·53 guilders per 100 kg. for head sugar.

We estimate the consumption in the territory of the Dutch East Indies at 350,000 tons, all the balance being available for export.

The destination of the 1928 export was as detailed below, in metric tons, and we give the corresponding figures for two previous years as a comparison. The stocks of sugar still existing to the beginning of the 1928 grinding season are put at 6704 tons and on the 30th April, 1929 they were insignificant.

The 1928 Java Sugar Crop.

I.—Cane Crop.

Residencies and Totals.	Number of Factories.	Land under Cane. Hectares.	Acres.	Cane Harvested. Tons.	Tons. per Acre.	Kg. per Hectare.
Cheribon	11	12,126	29,951	1,488,274	49·75	124,900
Pekalongan	17	17,948	44,332	2,414,842	54·44	136,700
Banjoemas	5	6,906	17,058	886,262	52·08	129,900
Kedoe	2	4,628	11,431	686,432	60·02	150,700
Djokdjakarta	17	17,497	43,218	2,243,996	51·30	128,800
Soerakarta	16	19,755	48,795	2,674,365	55·16	138,500
Semarang	11	11,085	27,380	1,380,767	50·30	126.300
Madioen	6	9,747	24,075	1,283,474	53·56	134,500
Kediri	20	26,011	64,247	3,231,324	50·30	126,300
Soerabaja	35	29,080	71,828	3,939,392	55·08	138,300
Pasoeroean	27	27,426	67,742	3,366,048	50·30	126,300
Besoeki	11	12,877	31,806	1,699,903	52·65	132,200
Total 1928	**178**	**195,086**	**481,863**	**25,295,079**	**52·53**	**131,900**
„ 1927	178	184,462	455,806	21,113,044	46·04	115,600
„ 1926	178	179,702	444,038	18,683,145	42·08	105,660
„ 1925	179	178,290	439,695	19,023,897	43·19	108,446
„ 1924	179	172,311	424,945	18,029,702	42·36	106,357
„ 1923	179	162,481	401,485	16,078,051	40·04	99,986
„ 1922	182	160,908	397,443	16,759,106	42·05	105,816
„ 1921	183	159,474	394,060	14,939,679	37·89	95,125
„ 1920	183	156,069	385,647	14,398,238	37·34	93·732
„ 1919	179	137,655	340,138	13,075,128	38·10	96·517

II.—Sugar Extracted.

Residencies and Averages.	Kg. per Hectare.	Lbs. per Acre.	On 100 Cane.	Yearly maximum output of any single factory. Kg. per Hectare.	Lbs. per Acre.
Cheribon	14,900	13,292	11·93	17,830	15,877
Pekalongan	15,900	14,183	11·63	19,350	17,265
Banjoemas	14,200	12,669	10·93	15,910	14,192
Kedoe	15,500	13,827	10·29	17,060	15,220
Djokdjakarta	15,900	14,183	12·34	22,010	19,635
Soerakarta	15,900	14,183	11·48	20,170	17,998
Semarang	15,000	13,381	11·88	19,230	17,156
Madioen	16,400	14,629	12·19	19,000	16,952
Kediri	14,400	12,936	11·40	19,780	17,648
Soerabaja	16,300	14,551	11·79	21,750	19,405
Pasoeroean	13,900	12,400	11·01	20,690	18,459
Besoeki	13,200	11,775	9·98	19,240	17,165
Average 1928	**15,100**	**13,433**	**11·45**	**22,010**	**19,635**
„ 1927	12,800	11,413	11·09	20,416	18,247
„ 1926	10,966	9,782	10·38	18,581	16,578
„ 1925	12,881	11,491	11·88	19,399	17,308
„ 1924	11,582	10,326	10·88	18,015	16,097
„ 1923	10,965	9,784	10·97	16,362	14,480
„ 1922	11,226	9,950	10·61	16,362	14,480
„ 1921	10,517	9,321	11·04	17,911	15,875
„ 1920	9,892	8,826	10·55	15,178	13,540
„ 1919	9,706	8,657	10·06	14,639	12,957

III.—Sugar Production in Tons.

Residencies and Totals.	First Sugars.	After-Products.	Total Production. After-products as 4 : 3.	Molasses. Solidified.	Molasses. Liquid.
Cheribon	170,787	8,869	177,462	1,830	38,599
Pekalongan	272,689	10,584	280,674	16,301	57,300
Banjoemas	94,320	3,513	96,970	—	24,341
Kedoe	69,228	2,018	70,750	—	24,490
Djokdjakarta	271,301	6,916	276,514	—	62,824
Soerakarta	302,410	4,984	306,181	—	68,578
Semarang	161,994	2,400	163,829	676	38,287
Madioen	155,252	1,785	156,617	—	38,541
Kediri	342,296	34,128	368,000	—	108,129
Soerabaja	452,623	16,047	464,799	31,630	91,539
Pasoeroean	328,210	55,783	370,077	3,311	104,244
Besoeki	155,320	19,312	169,878	18,855	37,763
Total 1928	**2,776,430**	**166,339**	**2,901,751**	**72,603**	**694,635**
„ 1927	2,279,001	83,111	2,341,538	85,051	566,102
„ 1926	1,890,544	68,142	1,941,649	98,525	593,470
„ 1925	2,205,201	77,876	2,263,479	71,679	546,520
„ 1924	1,924,942	54,427	1,966,237	82,504	483,768
„ 1923	1,740,895	31,655	1,764,636	103,842	Unknown
„ 1922	1,749,640	39,609	1,779,557	62,125	„
„ 1921	1,632,067	34,620	1,658,032	74,892	„
„ 1920	1,497,244	30,060	1,519,562	164,459	„
„ 1919	1,297,320	23,977	1,315,158	96,303	„

IV.—Sub-Division of the Crop in Percentages according to Assortments.

Residencies and Averages.	Plantation White Sugar: First running.	Plantation White Sugar: Second running.	Channel Assortment Refining Crystals, 96·5°Pol.	Channel Assortment Refining Crystals, 98° pol.	After-products.	Total.
Cheribon	63·91	0·75	—	31·57	3·77	100
Pekalongan	71·88	1·33	0·56	23·38	2·85	100
Banjoemas	0·02	—	11·58	85·67	2·73	100
Kedoe	—	—	18·18	79·67	2·15	100
Djokdjakarta	92·24	—	0·58	5·30	1·88	100
Soerakarta	98·77	—	—	—	1·23	100
Semarang	66·55	1·14	1·78	29·40	1·13	100
Madioen	98·66	0·46	—	—	0·88	100
Kediri	73·31	0·39	3·25	16·06	6·99	100
Soerabaja	65·59	0·19	3·61	28·00	2·61	100
Pasoeroean	33·48	—	8·58	46·63	11·31	100
Besoeki	39·57	—	5·44	46·41	8·58	100
Average 1928	**65·54**	**0·35**	**3·44**	**26·35**	**4·32**	**100**
„ 1927	63·60	0·30	—	33·50	2·60	100
„ 1926	59·90	0·50	19·70	17·20	2·70	100
„ 1925	56·99	0·55	21·23	18·62	2·61	100
„ 1924	54·45	0·99	16·78	25·69	2·09	100
„ 1923	53·11	1·06	15·20	28·91	1·72	100
„ 1922	52·85	1·53	16·46	27·45	1·71	100
„ 1921	53·42	0·12	15·33	28·05	3·08	100
„ 1920	51·71	0·83	15·08	30·41	1·97	100
„ 1919	49·70	2·10	23·30	23·10	1·80	100

V.—Percentage Composition of the Cane Plantings of :—

Variety.	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.
B 247	26	20½	17¼	15½	12¼	8¼	4¾	1¼	¼
POJ 2878	—	—	—	—	—	—	¾	12½	66½
Various POJ canes	10	7	7½	6½	4¼	4¾	6¾	10¾	4¾
EK 2	6	6½	6½	6	6½	6	5	4	¾
EK 28	32	39	39	40	43½	45¾	44	35½	13
F 90	3	3	3¼	3	3	2¾	2½	2	½
DI 52	14	15	18½	21½	22½	24¾	27¾	26	11¾
Cheribon	1	½	—	—	—	—	—	—	—
Tjep 24	1	1	—	—	—	—	—	—	—
SW 3	2	2	2½	2¾	3	3	3	2¼	½
Various	5	5½	5½	4¾	5	4¾	5½	5¾	2
Total	100	100	100	100	100	100	100	100	100

VI.—Factory Results during the Last Decade.

	1922	1923	1924	1925	1926	1927	1928
Cane—							
Sucrose	12·87	13·06	13·10	13·90	12·40	12·90	13·50
Fibre	13·19	13·14	12·90	12·80	12·80	12·70	12·70
Bagasse—							
Sucrose	3·85	3·75	3·60	3·30	3·00	2·90	2·90
Moisture	46·30	46·49	46·30	45·50	48·70	45·50	45·20
Sucrose Extracted by Mills	92·90	92·20	92·80	93·90	94·35	94·73	94·07
Sucrose in Filter-press Cakes	3·55	3·20	4·10	3·80	3·50	3·40	3·70
Sucrose in Juice per 100 Cane	11·96	12·04	12·17	13·08	11·70	12·22	12·70
Purity of Raw Juice	84·60	84·60	83·70	84·00	80·90	83·30	84·30
Purity of Final Molasses	32·00	31·30	30·50	30·50	30·00	29·30	30·10
Calculated Available Sugar	11·23	11·51	11·51	12·45	10·87	11·59	12·45
Sugar Extracted per 100 Cane	11·08	11·43	11·44	12·38	10·85	11·62	12·16
Sucrose turned out per 100 of :—							
Cane	10·60	10·92	10·92	11·82	10·33	10·45	11·59
Sucrose in cane	82·36	83·10	83·35	85·03	83·30	85·50	85·80
Sucrose in juice	88·34	90·71	89·80	90·40	88·30	90·50	90·70
Sucrose Lost per 100 of :—							
Cane	2·27	2·14	2·18	2·08	2·07	1·77	1·91
Sucrose in cane	17·64	16·90	16·65	14·97	16·70	14·50	14·20
Sucrose in juice	11·35	9·29	10·20	9·60	11·60	9·50	9·30
Lost in Bagasse per 100 of :—							
Cane	0·91	1·02	0·93	0·85	0·71	0·68	0·73
Sucrose in cane	7·07	7·77	7·10	6·10	5·73	5·60	5·40
Lost in Filter-press Cake per 100 of :—							
Cane	0·09	0·09	0·07	0·07	0·06	0·07	0·08
Sucrose in cane	0·70	0·69	0·50	0·50	0·48	0·56	0·57
Sucrose in juice	0·75	0·72	0·60	0·50	0·50	0·60	0·60
Lost in Molasses per 100 of :—							
Cane	0·98	0·80	0·90	0·92	1·04	0·79	0·84
Sucrose in cane	7·62	6·09	6·90	6·60	8·39	6·46	6·24
Sucrose in juice	8·17	6·65	7·50	7·10	8·90	6·90	6·60
Unaccountable Losses per 100 of :—							
Cane	0·29	0·23	0·28	0·24	0·26	0·23	0·25
Sucrose in cane	2·25	2·35	2·15	1·77	2·10	1·87	1·89
Sucrose in juice	2·43	1·92	2·10	2·00	2·20	2·00	2·00

EXPORTATION OF JAVA SUGAR IN METRIC TONS.

DESTINATION.	1926.		1927.		1928.
Netherlands	71	..	33,002	..	14,823
Belgium	309	..	6,122	..	14,901
United Kingdom	4	..	10,791	..	12,293
France	618	..	42,963	..	77,506
Germany	10	..	25,917	..	14,673
Russia and Finland	3,349	..	—	..	—
Norway	—	..	—	..	51
Italy	—	..	309	..	1,829
Balkan States	—	..	7,216	..	4,267
Poland	—	..	1,028	..	—
Other European States	—	..	308	..	1,120
United States	—	.	206	..	4,806
Port Said, etc., f.o.	6,388	..	54,517	..	206,757
Erythrea and It. Somaliland	—	..	644	..	145
Fr. Somaliland and Abyssinia	—	..	436	..	104
British Somaliland	—	..	621	..	155
British East Africa	208	..	1,717	..	4,095
Arabia	557	..	645	..	13,281
British India	753,712	..	822,481	..	1,091,296
Aden	3,139	..	9,295	..	13,648
Mesopotamia, Persia and Afghanistan	—	..	325	..	—
Penang	22,819	..	24,369	..	25,213
Singapore	85,332	..	83,871	..	87,687
Siam	33,750	..	29,878	..	27,589
Fr. Possessions and Protectorates in Hindostan and Indo-China	2,462	..	7,311	..	8,463
Hongkong	184,728	..	190,892	..	266,083
China	167,861	..	173,474	..	322,901
Japan and Formosa	457,681	..	447,600	..	265,261
Vladivostock	—	..	6,173	..	3,503
Philippine Islands	—	..	173	..	879
Australia	157	..	513	..	670
New Zealand	—	..	19,676	..	52,474
Other Countries	531	..	251	..	13,617
Unknown	—	..	5	..	—
Total	1,723,686	..	2,002,729	..	2,549,990

JAVA SUGARS.—In Java the percentage production of S.H.S. (superior head sugar, D.S. No. 25) has been gradually increasing, having progressively risen from 53·66 per cent. in 1921 to 65·54 per cent. in 1928. Other figures for this latter year were : D.S. No. 16 and higher, 26·35, muscovados, D.S. 12 to 14, 3·44, and molasses sugars, 4·21 per cent.

MOLASSES IN JAVA.—Some figures relating to the molasses produced in Java in 1928 and the way in which it was utilized were recently published, and are summarized as follows[1]:—Total quantity made, 7,795,220 quintals. Utilization : hardened, for export, 9·46 ; unhardened in tins for export, 1·20 ; unhardened in tins for use in Java, 3·70 ; unhardened boiled in tank waggons for spirit factories in Java, 13·13 ; unhardened for export in bulk, 50·04 ; burnt under boilers, 6·33 ; for caramel preparation, 0·71 ; as soil fertilizer, 10·52 ; used in irrigation, 3·46 ; thrown away or lost in hardening, 1·44 ; and undetermined, 0·01.

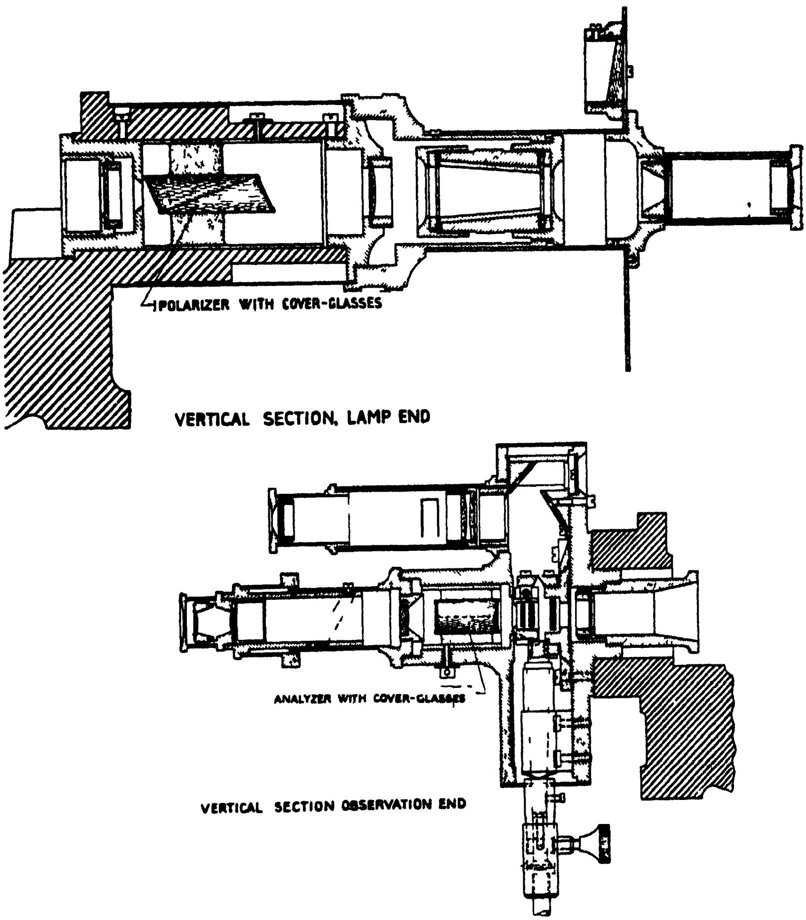
[1] *Archief*, deel III, 1929, No. 8, 528.

[1] *Archief*, deel III, 1929, No. 8, 507.

Java Technical Notes.

MANUAL OF THE POLARIMETER FOR JAVA SUGAR FACTORIES. **J. G. Smits.** *Archief, Mededeelingen,* 1928, 14C, 785-808.

This is a description of the essential parts of the saccharimeter written clearly and thoroughly. It describes these parts in detail, and discusses modifications of them that have been proposed. Then it goes on to give a specification for what the writer considers a model instrument for the purpose of chemical control in Java factories, the main items being as follows: Half-shadow apparatus; length of the tube, 400 mm.; Scale, from —30 to



SECTIONS OF THE JAVA MODEL SACCHARIMETER.

+110°; polarizing Nicol to be Jellet-Cornu, set in cork with cover glasses; single wedge compensation; cap for the latter; nickelin scale; trestle stand. Not the least important feature of the specification is that it shall be capable of being dismounted in the simplest way by means of screw-drivers for the purpose of cleaning the parts at suitable intervals. An idea of the way in which this is to be done can be seen from the two sections of the model instrument here reproduced.

NEW METHOD OF DEFECATING CANE JUICES. **G. H. de Vries.** *Archief*, 1928, **36**, No. 11, 263-267.

In this article, instead of adding milk-of-lime to the juice, as is always done, G. H. DE VRIES, chemist to one of the Java sugar factories, has considered the alternative, viz., adding the juice to the milk-of-lime, a *pH* of 7·0 being the final reaction. In the usual method of treatment, at no time is the juice alkaline, but in the latter the neutralizing process commences in a strongly alkaline medium, which can only be beneficial in precipitating non-sugars which in the usual way are not affected. In order to obtain an idea of the way in which juices treated according to this new method may settle out, a laboratory test was made in which to 10 c.c. of milk-of-lime at 5° Bé. increasing quantities of juice were added without heating, the time being observed for 50 c.c. of precipitate to settle out from 100 c.c. Here are some of the results obtained together with figures for the alkalinity of the clear juice expressed in mgrms. of SO_2 per litre, using phenol-red as indicator :—

Milk-of-Lime used c.c.	Raw Juice added c.c.	Time for Settling Hr.	Min.	Alkalinity Mgrms., SO_2, Litre
10	500	3	40	323
10	600	1	20	198
10	700	0	30	106
10	800	0	10	38
10	850	0	5	0

Following this, comparative tests were made which more closely corresponded with the conditions of practice, and these are thus summarized :—

	New Method Cold c.c.	New Method After Boiling c.c.	Old Method Cold c.c.	Old Method After Boiling c.c.
Mud per 1000 c.c. juice after complete settling	220	110	190	100
Appearance of the clear juice	almost clear	clear	opalescent	opalescent
Colour of the juice	light brown	yellow	light brown	dark yellow

Thus a better clarification altogether was obtained in these laboratory tests by the new method of working. There was a greater volume of precipitate, pointing to a more thorough elimination of impurities, and the juice finally obtained was both lighter in colour and clearer. It appears worth while to look further into this method of liming and especially to carry out some experiments on the factory scale.

FURTHER TESTS WITH THE MECHANICAL STOKING OF BAGASSE. **E. C. von Pritzelwitz van der Horst.** *Archief*, 1929, **37**, I, No. 8, 241-255.

In a previous article some tests with a new mechanical bagasse stoker were described,[1] and now an account is given of several types of mechanical appliances designed for this purpose. Certain of these will be submitted to closer examination next season, though already it would seem that the mechanical and automatic stoking of bagasse is possible in a simple and satisfactory way. Thus at the Lestarie s.f. (Fig. 1) in an apparatus designed by J. F. GOGELEIN and his engineer Mr. SCHOONENBERG, the rake-carrier *A* fills the storage-bin *B* beneath it, and from thence controlled by the steel-plate *P*, the bagasse is conveyed in a layer of uniform thickness, by the

[1] *I.S.J.*, 1929, 92.

carrier C in a horizontal direction to the left, as sketch. The forward movement of the carrier C is actuated by the ratchet-wheel D, which in turn is moved by the ratchet E, this latter being given a to-and-fro movement by the eccentric F. When the carrier C has been filled with bagasse, a certain quantity falls into the chute H, which is rotatable from the point J, and can move only between the positions H^1 and H^2. At both places the chute H has sufficient inclination in order to allow the material to glide into the fire-box of the furnace. So long as the layer of bagasse is below the level or stand I, the counter-weight K maintains the chute at H^1; but as soon as there is a surplus feed from the carrier C, and the layer of bagasse reaches the level II, then the weight of the chute H lifts the counter-weight K, and the chute reaches the position H^2. This backward movement causes the

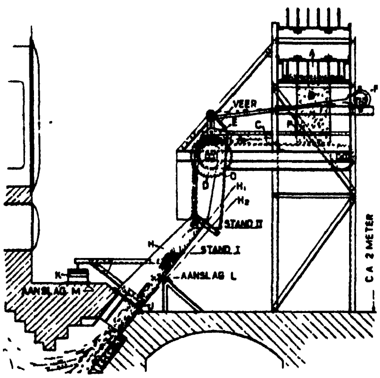


FIG. 1.

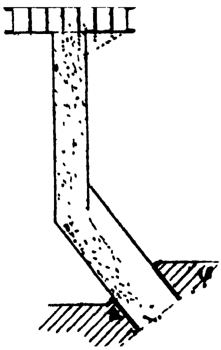


FIG. 2.

chain O to pull the ratchet out of place, the carrier C being thus brought to a standstill. Lastly when the bagasse has fallen again to the level I, operations are resumed. At the conclusion of the article, it is remarked that it would seem as though the feeding of bagasse might be done by means of the simple arrangement shown (Fig. 2) which does away with all moving parts, contrary to the other devices under test. Preliminary tests showed that it is possible to drop bagasse in a continuous way through the chute, provided that certain proportions are observed in construction, especially between the thickness of the layer on the inclined surface, and the section of the chute above it.

FUNDAMENTALS OF SACCHARIMETRY. **K. Douwes Dekker.** *Archief, Mededeelingen,* 1928, No. 14B, 753-783.

Firstly, the establishment of the 100° point of the saccharimeter is dealt with, and the literature on this subject by HERZFELD and SCHÖNROCK,[1] BATES and JACKSON,[2] KRAISY and TRAEGEL,[3] and of STANEK,[4] is summarized. In Java at the present time the recommendations of the International Congress of 1900 are only partly followed. Polarizations may be made with an instrument standardized at 20°C., using a solution which contains 26 grms. of sugar in 100 true c.c. (at 20°C.). On the other hand, most Java chemists still employ the old method of using a solution containing 26·048 grms. of sugar in 100 Mohr c.c. (at 17·5°C.). Hence the question arises what difference there

1 *I.S.J.*, 1924, 501.
2 *I.S.J.*, 1917, 380.
3 *I.S.J.*, 1919, 520.
4 *I.S.J.*, 1921, 588.

is between the two procedures. Calculation shows that 100 Mohr c.c. correspond to 100·235 true c.c., and that the concentration of a solution of 26·048 grms. of sugar in this volume is 0·259869. If this were heated to 20°C., the volume would become 100·306 c.c., making the concentration 0·259685, that is a difference of 0·12 per cent. between the two results. Hence, using the old solution, and raising its temperature to 20°C. for the polarization, instead of a result of 100, one of 99·88 would be obtained. On the other hand, if one were to use the flask calibrated to take 100 Mohr c.c. for the solution of 26·048 grms. of sugar, but were to make up to the mark at 20°C., instead of at 17·5°C., then the concentration would be 0·259854, giving a solution 0·056 per cent. diluter than the 1900 Congress solution. In other words, in place of a polarization of 100, one of 99·94° would be obtained. Calculating similarly, and allowing for all expansion effects of the flask, the tube, the nickel scale of the polarimeter, etc., the author has compiled the following table, which relates to solutions prepared and polarized under the following conditions: weight of sugar, 26·048 grms.; flask calibration, 100 Mohr's c.c. (at 17·5°C.); solution made up at temperatures varying from 25 to 32°C.; saccharimeter standardized at 20°C.; temperature of polarization, 25 to 32°C.

Temperature at which made up	Temperature at which polarized. 25°	26°	27°	28°	29°	30°	31°	32°
25°	**99·78**	99·72	99·65	99·59	99·53	99·47	99·41	99·35
26°	99·81	**99·75**	99·68	99·62	99·56	99·50	99·44	99·38
27°	99·84	99·78	**99·71**	99·65	99·59	99·53	99·47	99·41
28°	99·88	99·81	99·75	**99·68**	99·62	99·56	99·50	99·44
29°	99·90	99·84	99·78	99·72	**99·65**	99·59	99·53	99·47
30°	99·94	99·87	99·81	99·75	99·69	**99·63**	99·56	99·50
31°	99·97	99·91	99·84	99·78	99·72	99·66	**99·60**	99·53
32°	100·00	99·94	99·88	99·82	99·75	99·69	99·63	**99·57**

Probably the temperature coefficient for sucrose is 0·04°V. for 1°C., too low a value having been accepted heretofore. A further important point is that the polarization of pure sugar under the conditions which are operated in Java is about 99·6 to 99·7°V., which therefore deviates rather much from what has been regarded as the normal.

JAVA RECORDS.—In Java during 1928 records were established for: quintals of cane per hectare, quintals of sugar per hectare and the yield.[1] Thus for 1926 the figures were: 1057, 109·7, and 10·38; for 1927 they were 1156, 128·2, and 11·09; but for 1928 they reach 1319, 151·3, and 11·45 per cent.

SUGAR AS FOOD.—" To modern women vitality is most precious." This is the heading of an interesting booklet being used by The American Sugar Refining Company. Information about sugar and excellent recipes are included. The energizing properties of sugar, the dangers of eliminating sugar from the diet, erroneous ideas about sugar and the teeth, are explained.

JAVA WHITES.—A criticism by J. E. Roem[2] is made of the quality of Java white sugars, which are inferior to some plantation grades made elsewhere, and certainly of lower quality than European white granulated. He has noticed that the quality gradually declines during the season, this being due largely to the circulation of molasses. If *A*, *B*, and *C* sugars are double purged together, a wash lower in purity, higher in colour and viscosity is obtained than when *C* is so treated separately from the other two.

1 *Archief*, deel III, 1929, No. 8, 527.
2 *Archief*, 1928, 36, II, 652-656.

Columbus Meeting of the Sugar Division of the American Chemical Society.

Another successful meeting of the Sugar Division of the American Chemical Society was held at Columbus, Ohio, in May. A number of the papers read dealt with molasses, and incidentally it was brought out that it is highly desirable that this term should be defined in such a way as to dispel the uncertainty that now exists. Following are abstracts of the interesting papers presented :—

Adjustment of Acidity of Molasses Fermentations.—F. M. Hildebrandt. In producing alcohol from cane molasses by fermentation, it is necessary to add acid to the diluted molasses in order to secure the maximum yield. The quantity of acid necessary differs with various types of molasses and even with successive shipments of a single type. Experiments show that the maximum yield is obtained when sufficient acid is added so that there is no tendency for the *pH* of the fermentation solution to drift toward the acid side during the fermentation.

Automatic pH Recorders in Refinery Alkalinity Control.—A. L. Holven. The possibility of replacing colorimetric hydrogen-ion control of refinery products by a centralized automatic control based on *pH* recorders has been investigated. The chief obstacle to such an application was the lack of a suitable continuously indicating electrode. While the bare wire tungsten electrode in combination with a calomel half cell appeared the most promising of a number of combinations tested in various refinery products, this electrode proved to have the following objectionable characteristics : (1) Calibration varies with variation of composition of sugar product under control ; (2) not readily interchangeable, because of individual differences of characteristics ; (3) lack of permanence ; and (4) sensitiveness toward poisoning. Until a more reliable type of indicating electrode, requiring fewer replacements and less attention, is developed, the general application of *pH* recorders to refinery alkalinity control appears impractical.

Asbestos as a Laboratory Filter-Aid.—J. F. Brewster and F. P. Phelps. Asbestos is treated with 25 per cent. sodium hydroxide solution and boiled 30 minutes without allowing for evaporation. It is washed by suction with hot water, then treated 30 minutes with aqua-regia and washed with hot water until free of soluble matter. By this treatment the extremely fine material is removed, leaving the longer-fibred asbestos which will not pass retainers such as fine silk or sintered Jena glass.

Double Compounds of Sugars with Salts.—J. K. Dale. Five new double compounds of sugars with salts have been prepared. A crystalline compound of fructose and calcium tartrate was first found in an old fruit syrup and later prepared from fructose, tartaric acid, and calcium acetate. The pentose sugars, xylose and arabinose, each gave crystalline compounds with calcium chloride, having the formula xylose-$CaCl_2.3H_2O$, and arabinose-$CaCl_2.H_2O$ respectively. Mannose with $CaCl_2$ gave two isomeric compounds, one which has the formula, mannose-$CaCl_2.2H_2O$, can be directly correlated with beta mannose, but the other isomer having the formula, mannose-$CaCl_2.4H_2O$, shows an unusual polarimetric behaviour which does not parallel that of alpha mannose, and hence may be a compound of a hitherto unknown form of mannose.

Feeding Sugar to Cattle.—W. D. Horne. Residual beet sugar molasses and cane sugar molasses or black-strap have been very extensively used in cattle feeding, due to their cheap nutritious carbohydrates and their appetizing effect. Their high ash content restricts their use to a smaller amount than

could be desired. Experiments on feeding raw sugars, and high test raw molasses show advantageous financial results, suggesting new outlets for the world's cheap excessive sugar supply.

Literature of Molasses Utilization.—A. R. CHOPPIN and JAMES R. WITHROW. The paper is a survey of the available literature on the subject of the utilization of cane and beet molasses. It discusses the uses to which this product has been put, or is at present employed, among the most important of these being its use as a raw material for the production of alcoholic liquors such as rum and arrack, its use as a feed stuff for cattle, for the production of motor spirits, in the baking industries, as a fuel, fertilizer, etc. The paper also touches on some of the proposed uses and their limitations, such as the production of fuel gases, the recovery of nitrogenous compounds of cane molasses, etc. Brief mention will also be made of the various methods proposed for the recovery of sugar from molasses.

The Determination of Gums in Beet Products.—A. R. CHOPPIN and JAMES R. WITHROW. The hydrochloric acid-alcohol method for the determination of gums in sugar products as given by RUFF and WITHROW[1] gives very satisfactory results with cane sugar products. Some difficulty has been experienced in industry in applying the method to beet sugar products. The present work was designed to discover the bases, if any, and to overcome these objections and limitations, where possible. The chief difficulty we have found to be one of acid concentration. In low acid concentration the gums and other products precipitated from beet sugar molasses by the method above were themselves a syrupy mass which adhered to the precipitation vessel and could not be transferred to the filter. No such difficulty was encountered in cane sugar products. The ash precipitated with the gums was also high. This is probably due to the high calcium salt content of the beet products. The factors discussed in the paper which influence the accuracy of the method are acid concentration, alcohol concentration, kind of alcohol used for precipitation, time of standing after precipitation, time and temperature of drying and igniting, etc.

Electrical Conductivity of Syrups and Molasses.—F. W. ZERBAN and LOUIS SATTLER. The per cent. of ash in the various types of molasses produced in the raw cane sugar factory can be calculated by the same formula that was previously developed for raw cane sugars, namely 0·0001757 $(9{\cdot}13K + 1935 - K_1)$, provided that 0·05 grms. of molasses, plus 4·5 grms. of pure sucrose is used per 100 ml. of solution and the final result multiplied by ten, making the factor in the formula 0·001757. K is the specific conductance $\times\ 10^6$ of the solution itself, and K_1 that of the solution acidified with 0·25 normal hydrochloric acid at the rate of 5 ml. acid added to 200 ml of solution. If the addition of pure sucrose is omitted, the factor must be changed to 0·001640. The same formulas also hold approximately for cane syrups, but for more accurate results they must be slightly modified. For refinery syrups the factors are considerably lower than for the products of the raw sugar factory. Filtered syrups require the lowest factors, 0·001647 with added sucrose, and 0·001551 without sucrose. For unfiltered syrups the factors are 0·001662 and 0·001566 respectively, and for final syrups they range from 0·001700 to 0·001731, and from 0·001590 to 0·001622 respectively, varying with the refinery by which the syrups are produced. The formula gives more widely applicable and generally more accurate results than the C-ratio method, the same as was observed in the case of raw sugars. Conductometric

[1] *Jl. Ind. and Eng. Chem.*, 1922, **14**, 1131.

titrations with alkali have shown that the differences in the factors shown above are probably due to the effect of boneblack which appears to change the relative proportions of the cations in the salts present. This question is being further studied to devise a second correction which will result in a formula applicable to all products, whether treated with boneblack or not.

The Czecho-Slovakian Sugar Industry in 1928-29.

(Department of Overseas Trade Report.)

Czecho-slovakian sugar manufacturers and refiners had a disturbed season in 1928 owing firstly to the failure of the international negotiations for the restriction of production, and secondly to the reduction of the duty on raw sugar entering Great Britain. At the close of a satisfactory campaign in 1927-28, during which the sugar produced amounted to 1,224,849 metric tons in raw sugar value (an increase of about 200,000 tons as compared with 1926-27), sowings of beet were reduced by 9·7 per cent. in 1928 in anticipation of a slump owing to previous over-production and in accordance with the decisions of the international sugar conference held in Paris between representatives of the Cuban and European sugar industries. The beet sown area in the spring of 1929 has, however, been increased by 15 to 20 per cent.

In April, 1928, much of the prosperity of the refining industry was threatened by the reduction of the British customs duty on raw sugar designed to encourage sugar refining in Great Britain. Hitherto the major portion of the Czecho-slovakian refined sugar, including practically the whole of the superior brands for the production of which the industry has largely specialized, had been exported to Great Britain. The sudden curtailment of the British market therefore dislocated the organization of the industry, which has since been diligently seeking other markets. After long negotiations with the Government, which entailed the raising of the internal price of sugar from about Cr. 6·30 to Cr. 7 per kilogram, a subsidy was granted in the form of remitted taxation, amounting to a sum yet to be finally determined, but in any case exceeding Cr. 100 millions per annum. Nevertheless, the exports of refined sugar to Great Britain from September to January last declined by about half, as compared with the corresponding period in 1927-28, and the pressure to develop new markets has been the immediate cause of the raising of the duties on sugar in Germany and Austria, whilst Italy and Denmark are expected to follow suit. Although the total exports from September to January have actually risen as compared with the previous year the redoubled efforts of the Czecho-slovakian exporters seem to be raising further obstacles in their own path. In the first three months of the 1928-29 campaign 1,027,429 metric tons were produced, as compared with 1,223,169 tons in 1927-28, exports rose from 267,721 metric tons to 280,644 tons, and internal consumption fell from 110,099 metric tons to 105,282 tons. (The foregoing figures are in raw sugar value). It is as yet too early to predict the results of the present endeavours at adjustment. There have, however, been a number of amalgamations of small with larger firms, and there is a tendency to tighten the cartel regulations as well as an attempt to close down the few " outsiders."

According to the results of an official inquiry the cost of production of Czecho-slovakian raw sugar is Cr. 200 per 100 kilograms ex works, as compared with an export price of Cr. 137 f.o.r. Aussig, and that of refined sugar Cr. 300 as compared with a world price of Cr. 180. The cause of these high production costs is attributed to over-capitalization, the effects of currency deflation and the use of obsolete machinery. At a meeting between representatives of Czecho-slovakia, Germany and Poland, an export quota, amounting to about two-thirds, was allotted to Czecho-slovakia for the season 1928-29, the remainder to be divided between the other two countries. As a basis for further discussions the amount left for export was fixed at approximately 11½ million quintals of raw sugar. In order to increase the home consumption of sugar, the duty on cocoa beans has been reduced for the purpose of encouraging the manufacture of chocolate and confectionery.

Publications Received.

Methods of Chemical Control for Cane Sugar Factories and Gur Refineries. Adopted by the Sugar Technologists' Association of India. (On sale by the Association at Seorahi, Gorakhpur, India, or in London by Norman Rodger, 2, St. Dunstan's Hill, E.C.3.). Price : 10s. 6d., post free. 1929.

It was announced at the first meeting of the S.T.A. of India, held in November, 1927, that a Committee had been appointed to draw up a scheme of chemical control for sugar factories and gur refineries in India. No time has therefore been lost by the Committee, consisting of Dr. HALDANE and Messrs. SRIVASTAVA and BANERJI, in so doing. They have compiled simple control methods which should have the desired effect in promoting unification in analysis and calculation in India. Directions are generally clearly written, and altogether the small book must be regarded as a very useful contribution to sugar-house control. Indeed, it is to be expected that the system elaborated, owing to its simplicity and the clearness with which the calculation of the data is set forth, may be found serviceable in countries other than that for which it is particularly intended.

MR. NOËL DEERR contributes a foreword, but it seems more than likely that the Committee mentioned has been indebted to no small extent to his considerable knowledge and experience. Certain of the most important apparatus described are known to have been originated by him, and several of his formulae are used. One finds applied here for the first time in any textbook DEERR's algebraical expressions for establishing standards of comparison for milling plants,[1] which expressions are here recorded as part of the daily routine of the factory. Certain of the tables appear to have been specially worked out for this book. Regarding the actual methods used, one notes for the determination of sucrose by double polarization that DEERR's method, using sulphuric acid, aluminium sulphate and baryta, is recommended. Invert sugar can be determined by the MUNSON and WALKER gravimetric process, or volumetrically, using ferrocyanide as external indicator. There are a number of original points here and there brought forward in these control methods, which as a whole certainly will be found of interest among cane factory chemists.

The Handbook of the British West Indies, British Guiana and Honduras, 1929-30. By Sir Algernon Aspinall, C.M.G., C.B.E. 232 pages. With Coloured Map. (West India Committee, London, E.C.3.). Price 5s. net.

This Handbook, which first appeared in 1926, has been issued in a new edition entirely re-arranged and with much additional information added. It differs from the author's well-known "Pocket Guide to the West Indies" in being primarily intended for the information of commercial interests having business with the Caribbean. Thus we have particulars of the constitution, industries, finance and trade of each colony, particulars of agricultural and commercial bodies connected with them, a chapter on currency and finance with particulars of all the banking establishments, details of the steamship companies and railways serving these colonies ; while there is a chapter which includes a list of the principal sugar estates and factories. Altogether a useful handbook for the West Indian merchant to have in his office library.

Sugar Charts. We have received the following charts, dealing with Prices and Quantities on the Sugar Market, which are suitable for framing, and will be found useful for those making a close study of market conditions. These charts are complimentary, and those desiring copies should apply to the firms concerned.

(*a*) CHART SHOWING MOVEMENTS IN THE LONDON AND NEW YORK SUGAR MARKETS, 1925-28 : London Raw Terminal Market and Basis 96° Sugars c.i.f. U.K./Continent ; New York Sugar Exchange and Basis 96° Sugars, c. & f. New York. This is a useful Chart of prices issued by Messrs. CZARNIKOW LTD., Mincing Lane, London.

---

[1] *I.S.J.*, 1928, 247.

(*b*) CHART SHOWING THE IMPORTS OF REFINED SUGAR, RAW SUGAR, TOTAL OF ALL KINDS; IMPORT PER HEAD OF POPULATION AND PERCENTAGE OF IMPORTS OF FOREIGN REFINED, EACH YEAR; THE HIGHEST AND LOWEST PRICES OF TATE'S CUBES DUTY PAID, AND 88 PER CENT. RAW BEET (F.O.B.) AND 96° CENTRIFUGALS (C.I.F., U.K.) AND ALTERATIONS IN SUGAR DUTIES; 1860 TO 1928 INCLUSIVE. This is an annual Chart, issued by Messrs. TATE & LYLE LTD., the well known London and Liverpool sugar refiners.

(*c*) CHART SHOWING THE DAILY PRICES OF SUGAR EX-WHARF, LONDON AND 96° CENTRIFUGALS C.I.F., UNITED KINGDOM, DURING 1928: Also showing the Fluctuations of the four Principal Deliveries of the London Terminal White Sugar Market from 1924 to 1928; and the Daily Prices of the London Terminal Raw Sugar Market, instituted on October 1st, 1928, from October 1st to December 31st, 1928. This Chart is issued by Mr. GOLODETZ, of 117a, Fenchurch Street, London.

(*d*) CHART SHOWING U.S. INSULAR AND DOMESTIC PRODUCTION; WORLD CANE AND BEET AND TOTAL PRODUCTION; CUBAN CANE AND CUBAN PRICES, C. and F., NEW YORK; FOR THE YEARS 1901 TO 1929 (ESTIMATED). Issued by W. R. CRAIG & Co., 60, Beaver Street, New York.

(*e*) CHART SHOWING SUGAR MAP OF PERU WITH GRAPHIC EXPOSITION OF PRODUCTION, EXPORTATION AND CONSUMPTION IN PERU IN THE YEARS 1926-27. Compiled by the National Agrarian Society, Lima, Peru.

Using the Mercury Arc in the Spectrophotometric Analysis of Sugar Products. H. H. Peters and F. P. Phelps. Research Paper No. 38; Bureau of Standards. (Superintendent of Documents, Washington, D.C., U.S.A.). 1929. Price: 5 cents.

Wave length $\lambda = 560$ mμ has a particular importance in the spectrophotometric analysis of the absorption and transmission spectrum of technical sugar products. Through a simple measurement at this wave length, it is possible to arrive at a nearly correct estimate of colour in relation to the effective quantity of colouring material per grm. of dry substance. A rule has now been developed for calculating the specific absorptive index ($-\log t$) of sugar products at wave length $\lambda = 560$ mμ from the values of $-\log t$ measured at two of the wave lengths obtainable from the mercury vapour lamp. It has been tested for a large number of cane products and a few beet sugar products. In practically every instance it was found to hold true.

Materials Handbook. George S. Brady. First Edition. (McGraw-Hill Book Co., Co., Inc., London.) 1929. Price: 20s.

This is described as an encyclopaedia for purchasing agents, engineers, and others. It is a classification and description in alphabetical order of materials used in the arts and manufactures, and it would seem to fulfil a want that must have been often felt by many. Not so very long ago three or four kinds of steel or of brass sufficed to meet most requirements; but now, as one can see from this book, there are many special steels and alloys, alloy bronzes and brasses, and other new materials, some of which are of significance or of possible value in every industry. Building and finishing materials, industrial chemicals, oils and greases, woods, fibres, etc., are described throughout the book, short specifications for them being often given. This impresses us as a book which should prove distinctly useful to the engineer.

Varietal Tests of Russian Sugar Beets in America during 1927. Dr. George Stewart. (Amtorg Trading Corporation, New York). 1929.

Russian sugar-beet seeds, as a whole, did rather well in both United States and Canada during 1927. In eleven cases they outyielded somewhat, and in another case tied, in pounds of sugar per acre, the other varieties used as checks. In some cases the Russian varieties seemed to be both actually and significantly better and in others no better.

Brevities.

Costs in Cuba.—In the annual report of the Cespedes Sugar Co., Cuba, producing 242,345 bags from 279,452 tons of cane during 1928, the cost per bag (of 325 lbs.) is given as \$6·559, this including cost of cane, dead season and crop expenses, insurance, taxes, bags, freight, shipping expenses, and selling. This is equal to 2·018 cents per lb., as compared with 2·28 cents per lb. for the previous year.

Sugar in Bolivia.—According to the *Times*, a law destined to encourage a sugar industry in Bolivia has just been passed. It provides for the free importation of all machinery and accessories for the industry, but when production is sufficient for the needs of the country the existing sugar duties can be heavily increased. It is not expected that any indigenous sugar producing industry will be able to meet the internal needs for some years to come.

Slosson on Sugar.— Dr. Edwin E. Slosson, Director, Science Service, Inc., Washington, D.C., says : " Common sugar is almost an ideal food. Cheap, clean, white, portable, imperishable, unadulterated, pleasant tasting, germ free, highly nutritious, completely soluble, altogether digestible, easily assimilable, requires no cooking and leaves no residue. Its only fault is its perfection. It is so pure that a man cannot live on it alone." It is " crystallized energy."

Financial Aid for British Sugar Colonies.—Mauritius planters have received a loan of six million rupees to help them to keep their estates going ; the refund of this is guaranteed by means of an export duty on sugar. Antigua planters are also proposing to ask the Imperial Government for a loan at a low rate of interest to be repaid over a term of years, to prevent their sugar estates going out of cultivation during the present crisis.

Sir Henri Leclezio.—We regret to record the death of Sir Henri Leclezio, the " Grand Old Man " of Mauritius at the advanced age of 88. Sir Henri was an eminent lawyer, who engaged with conspicuous success in many public activities to the benefit of his country. He was for many years President of the Chamber of Agriculture, and of other local bodies. He was created K.C.M.G. in 1915. He was regarded with the greatest esteem by his fellow-colonists, and his death is a loss that must be keenly felt in Mauritius.

Sugar in Poland.—According to a D.O.T. Report, the internal consumption of sugar in Poland increased again in 1927-28 and was 11·8 kgs. per inhabitant, as compared with 10·4 kgs. in the preceding year. The production of white commercial sugar in the 1928-29 season is estimated at 670,000 tons, showing an increase of 166,000 tons, or approximately 33 per cent. over the last season ; it will meet the larger requirements of the local market and free about 300,000 tons for export. The financial assistance of the London market, in the form of advances against sugar exported, was again extended in the season under review.

Cuban Customs Regulations.—The Cuban Administrator of Customs has recently ruled that all importations of advertising material, whether allowed free entry or dutiable, must be invoiced and shown in the bill of lading. Free entry is allowed of catalogues, etc., imported as advertisements but intended for free distribution. But advertising materials received as a regular importation as a part or a whole of a shipment may become dutiable. Showing on the invoice and bill of lading the class, quantity, and details of the advertising material concerned will, therefore, be necessary to assist the customs authorities to determine what treatment to accord the consignment.

American Beet Factories.—A German commission recently touring beet factories in the U.S.A. made very laudatory remarks in regard to the Great Western Sugar Company. High praise was accorded to the beauty of the factory planning ; to the general staff organization ; to the continuous filtration of press cake ; and to the Steffen desaccharification working, the Johnstown plant in particular being very highly mentioned. Moreover, the laboratory system is excellent, and in factories having a slicing capacity of about 1750 tons not less than eight chemists in three shifts are employed. But Europe can teach America something about agriculture, since, states this report, farmers in the latter country " often do not know the fundamentals for raising a good crop."[1]

[1] *The Sugar Press*, 1929, 13, No. 2, 14.

Brevities.

SCIENCE.—Science is the soul of the prosperity of nations and the living source of all progress.—Pasteur.

MARKING GLASSWARE.—Mr. A. W. Knapp, Chemist to Cadburys of Bourneville, said at a recent meeting of the Society of Chemical Industry, that he had found nothing so good for the purpose of marking glassware as a 15 per cent. solution of button shellac in methylated spirit, allowed to stand in the cold for a day or two, and coloured with any spirit-soluble dye. This is applied with an ordinary pen as an ink.

SUGAR BAGS.—The Great Western Sugar Co., of Denver, Colo., have been making their own bags since 1922, the capacity of the factory now being about 48,000 per day. Even at this date the bag requirements of the organization have not been covered, though during the year 1928 about 9½ million were delivered. The capacity will be yet further increased, and it is hoped later, when sufficient bags are made for the sugar, to meet the demand for packing dried pulp.

BAGASSE UTILIZATION.—Factories burdened with an excess of bagasse may consider it worth while investigating some process of compressing the material into panels. Such panels, made in standard sizes, would form a useful and economical building material for tropical buildings, as bungalows, hutments, stores, garages and the like, especially when surfaced with a thin layer of cement or concrete. Properly rendered, such material would be fire, weather and insect proof, and would possess considerable qualities in respect of heat and sound insulation.

NICARAGUAN SUGAR PRODUCTION.—According to *Commerce Reports*, sugar production during 1927-28 in Nicaragua was estimated at 14,000 to 15,000 short tons, as compared with about 11,250 short tons during the 1926-27 season. Of the total exports, 8160 short tons were declared for shipment to the United States, as compared with 5585 short tons in 1927. This sugar goes entirely to canning factories on the Pacific coast. The remainder of the amount exported went in small lots to nearby Central American countries.

WEST INDIAN IMPORTS OF REFINED.—Investigations by the West India Committee into the extent of imports of refined sugar into the British West Indies show that taking thirteen separate colonies comprising this group (including British Guiana) Canada in 1927 supplied refined sugar to all but one, the United Kingdom to ten of them, the United States also to ten. The Canadian imports were consistently large, amounting in the case of Trinidad to about 1500 tons and of Jamaica to 1000 tons. Some 63 tons to Barbados was the largest U.K. export; while nearly 1000 tons of American refined went to the Bahamas.

REGISTRATION OF CHEMISTS.—Sugar factory chemists are to be registered by the South African Sugar Technologists' Association, and the following are proposed as the qualifications necessary to obtain such a certificate : A degree or diploma from certain recognised sugar schools, as the Imperial College, Trinidad, from a recognized University, or from the Institute of Chemistry. Or the candidate must have had five years experience in a sugar laboratory and also must have passed the Final Examination in Sugar Manufacture of the Department of Technology of the City & Guilds of London Institute. Similar registration in other countries is much to be desired, and might be enforced on corresponding lines.

FRENCH FACTORIES.—Very full statistics are published annually in France regarding her beet sugar factories,[1] and from the latest report the following figures (for 1927-28) are culled : Total factories, 108 ; *raperies*, 88 ; men employed during slicing, 27,534 ; women, 974 ; children, 355 ; daily wages in francs, men, 29·55 ; women, 16·64 ; children, 14·65 ; total hectares sown, 231,080 ; beets worked in metric tons, 6,139,861 ; yield in kilos. per hectare, 26·57 ; price of the roots per 1000 kg., 176·76 ; pulp produced in metric tons, 3,157,821 ; price obtained for it in francs per ton, 14·15 ; coal used in metric tons, 624,311 ; price of the coal in francs, 151·70 ; total sugar and molasses obtained in metric tons, 780,867 ; per 100 kg. of roots, 12·72 ; total molasses obtained in metric tons, 256,300 ; per 100 kg. of roots, 4·17. Other data given deal with the type of plant used and its capacity.

1 *Bulletin de Statistique et de Législation comparée.*

Review of Current Technical Literature.[1]

QUESTIONNAIRE ON CANE FACTORY MACHINERY IN THE PHILIPPINE ISLANDS. **Theo. Nickelsen.** *Committee Reports of the Sixth Annual Convention of the Philippine Sugar Association*, 1928.

Mr. NICKELSEN, Chairman of the Committee on Manufacturing Machinery of the P.S.A. circulated amongst his friends a very complete questionnaire designed to cover most of the machinery used in the cane factory, the purpose being to elicit useful practical information on matters to which some have given special study. In two previous issues Mr. NICKELSEN's own reply has been summarized,[2] and is now continued :—

Q. In your opinion is the turbine the ultimate prime mover for electric generation for use in the sugar-house ? *A*. It is becoming more evident every year that the turbine for electric generation under present operating conditions of our factories is not the ultimate unit that we might advocate for present day specifications and design. If the unit price of the apparatus is considered plus floor space and plus what is needed as safeguarding devices on the exhaust and steam lines in the way of receivers, separators and traps, also the safety device protections necessary in the boilers, tracifyers and superheaters, and the essential necessity for a higher priced operator with a little more than average intelligence in the turbine room, we find, after adding all these together and balancing them against a good Corliss engine, direct connected to the generator, that the latter will outweigh in reliability, and usefulness, anything the turbines may have to offer. Also that, if we add to the fore-going the Corliss engine's efficiency on a steam consumption basis, operating as a non-condensing unit under same conditions as the turbine together with its freedom from minor and major troubles, we cannot but wonder why the industry ever turned to the turbine as a prime mover for electric generation. *Q*. Will you enumerate some of the steam line and electric safety instruments and gauges you would like to see installed in your power plant ? *A*. High and low voltage regulators. Lightning arrestors. In steam lines, oil and water separators, tracifyers and separators in the boilers and cut out safety valves in exhaust lines to discharge into the atmosphere. *Q*. What is the economic limit of electric drive you would advocate for modern raw cane sugar manufacture, i.e. what parts of the plant would you suggest remain as steam driven units ? *A*. As far as Philippine and Hawaiian experience is concerned the electric drive for the mills is an unknown quantity ; the writer would advocate that the main driving units in the mill remain steam. However, there are more angles to look from than merely to provide a low pressure heating and boiling medium which will give up its heat readily as exhaust steam, for use in the boiling house, heaters, pre-heaters, evaporators and pans. If the question resolved itself into one of steam economy only, we might say that it would be advantageous to build a separate power house and completely electrify the plant, running the turbines or large compound Corliss engines with condensers, using the cold juices from the mills to replace in part the water for condenser purposes by building the heaters as part of the condensing system, for the use of these electric prime movers. In our present day operations we have conditions that do not call for the ultimate in steam economy in the factory but we do demand that the flexibility of our milling unit drives be of the highest, and we do not as yet recognize that the electric motor has the same flexibility as the present Corliss engines have. There should be standby piston pump units at the filter-press, boiler feed and fire-pump stations. *Q*. What type of water injection pump, and what drive would you prefer ? *A*. Direct connected centrifugal motor driven pumps in one unit with a standby spare unit of the same class and capacity to take care of the whole factory up to 1500 tons per day. If the factory is larger, one would advocate individual pumps in 1000 or 1500 tons cane per day capacity, together with a master pump capable of taking care of the total water needed when the whole plant is running to capacity. This insures flexibility and saving in steam consumption when cane for full capacity is unavailable. *Q*. What type of mud pumps would you advocate and why ? *A*. Centrifugal single stage up to 30 lbs. per square in. pressures, maximum, with a stand-

[1] This Review is copyright, and no part of it may be reproduced without permission.—Editors, *I.S.J.*

[2] *I.S.J.*, 1929, 219, 276.

by piston type pump, with suitable relief valves on discharge line. This latter pump would be a spare in case of breakdown and would be used to take care of an overload of mud to be met with in wet weather. There is no doubt that a duplex piston type of pump is flexible and can be used to increase the capacity of the filter presses by increase in speeds and pressures. *Q*. What are your ideas on lime pumps. *A*. A centrifugal pump 2 in. capacity 50 to 75 lbs. pressure with a lime mixing apparatus suitably screened. The return discharge pipe should be 1 in. to 1¼ in. diam. and not larger than 1½ in. so that the speed of the mixture through the pipes may be of such velocity as to insure self cleansing. The pump should be installed for a flooded suction and a slight suction head would be better. The piping layout should be such that all parts, especially at elbows and long straight level stretches may be easily cleaned and taken apart for inspection. *Q*. What types of condensate pumps connected to pans and evaporators would you install here? *A*. When of the centrifugal type these should be connected at as low a point as possible below the evaporator with check valves on discharge and suction lines. The top of the pumps should be connected with a source of high vacuum, up somewhere close to the condenser, in the dry vacuum system this same arrangement to be followed in connecting up the syrup pump. Vacuum equalizing lines can be used with equal advantage in piston type of pumps at these stations, but it should be borne in mind that the connexions for vacuum equalizing should be connected at points between the discharge and suction decks of the pumps. Water logging of calandrias may occur where a leak developes in the condensate pump or line. *Q*. What size and type would you advocate? *A*. High speed vacuum pumps (high speed only in comparison to the speeds of the older type pumps) with steam engine drives are giving good service in modern factories. Dry air vacuum-pump sizes are generally based on the pounds of water used in the condensers which in turn may be figured back to pounds of vapour from the different apparatus, which in turn is computed to tons of mixed juice from the mills and filter press stations, which again is made to read cane-tons per hour. Rough rules, found from practical experience plus assistance of NOEL DEERR indicate that a duplex 12 in. × 27 in. diam. cylinder vacuum pump, running at an average speed of 120 r.p.m. will take care of a factory milling 50 tons cane per hour working under 27 in. of vacuum at the pans and 26 in. in the condenser of the evaporator. Electric motor drive for these units either belt drive or else direct connected through reduction gears built integral with the motor bases is hereby advocated.

USE OF "SUPER-CEL" (KIESELGUHR) IN THE CANE SUGAR INDUSTRY. **Roy D. Elliot.** *Sugar News*, 1929, **10**, No. 3, 190-194.

"In the production of plantation white sugar by the sulphitation process, when the pan liquors are filtered with "Super-Cel," arguments for high sulphuring lose their force entirely. "Super-Cel" filtration decreases the viscosity, as determined by actual pan boiling, to a far greater extent than is possible by highly sulphuring a dirty juice. "Super-Cel" filtered liquor cannot be improved in so far as ease of boiling is concerned by high sulphuring. It is possible to obtain a uniform hard, sharp grain from clean pan liquors from which the syrup is easily expelled in the centrifugals. When "Super-Cel" is used, the only sulphuring of the pan liquors that is desired is sometimes a small amount necessary to throw out the maximum calcium sulphite. Sugar resulting from Super-Cel filtered pan liquors has good keeping qualities. The efficiency of Hyflo "Super-Cel" is such that thick-juices resulting from sulphured thin-juices can be filtered at a density as high as 63° Brix or more. At this density a purity increase is obtained of as much as one whole point, which alone puts sufficient additional quantity of sugar in the bag as to pay the cost of the entire filter station. In a sulphitation factory, either the thick-juice, the remelt molasses sugar, or the centrifugal run-offs, or all of these, may be filtered, depending upon local conditions and the market requirements. The cake resulting from the pan liquor filtration is slightly steamed, or blown with air, then removed from the press and mingled with the mud juices; this improves the filtration of the mud juices and reduces the polarization of the mud press-cake. The filtration of the thick-juice in a sulphitation factory will require about 0·5 per cent. "Super-Cel"

on Brix solids, and in a 1000-ton plant from 500 to 1000 sq. ft. of filter area will be necessary for this purpose. The re-use of the cake in the mud juice filtration will reduce the filter area for mud juices to between 2 and 3 square feet per ton of cane. The cost of this filtration will be absorbed by increased recovery of sugar and better working conditions."

"In the making of raw sugar, some factories experience no difficulties, in others mud juice filtration is a major problem. Various expedients are often resorted to in order to get the mud juice filtered, such as double settling, sulphuring and liming, overliming, high pressure pumping, and the use of excessive filter-area. In some cases overliming necessitates the return of the mud press filtrate back to the raw juice, as otherwise the clarified juice from the settling tanks, and the alkaline juice from the mud presses, would cause precipitation in the juice entering the evaporators. But when "Super-Cel" is used, filtration is easily accomplished without resorting to these objectionable expedients and the clarified juice reaches the evaporators with a minimum of colour and other impurities. Its use in mud juice filtration is very simple. The dry powder is added to the mud juices at the rate of 0·2 to 0·3 lbs. per ton of cane ground. The chief benefit of the use of "Super-Cel" in the filtration of mud juices is that the factory is enabled to operate at a maximum milling rate with a minimum of filter area and to produce a better quality of clarified juice. A factory grinding 4000 tons of cane per day and using 1½ sq. ft. of filter area per ton of cane showed a daily gain by using "Super-Cel" in the mud juice filtration. This was based upon the saving in cloth, heat losses, lime, labour, and broken frames due to high pressure pumping, when "Super-Cel" is not used. The filter area in this particular factory was unusually low, while in other factories sometimes as much as 3·5 sq. ft. per ton of cane may be required even with the use of "Super-Cel." Without "Super-Cel" as much as 6 sq. ft. per ton of cane is sometimes used. The cost of using "Super-Cel" will run between 1·5 and 2 centavos per ton of cane." This writer also gives an account of the advantages of using "Super-Cel" in the refining of sugar.

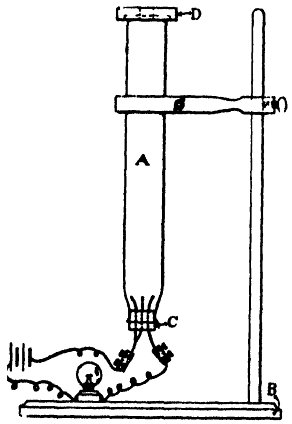
PRODUCTION OF REFINED SUGAR DIRECTLY FROM THE CANE. G. F. Keller. *The Planter*, 1929, 82, No. 19,361.

That of sugar is almost the only industry which still turns out its product in two distinct stages. Not long ago it was a technical necessity to proceed in that way. But the last few years have brought about a marked change in this situation. Theoretical and applied chemistry and better engineering have shown that the difficulties can be overcome, and that the day will come, when refined sugar, i.e., sugar of perfect whiteness and long durability, will be made directly out of the raw material in every individual factory, at even less cost than raw sugar is made to-day. No doubt, there are very strong interests against the refinery passing into history. Even the refining of the much improved raw sugars of to-day needs costly installations, but there is a still stronger reason which moves certain groups to oppose the tendency of suppressing sugar refining as an independent industry. The sugar refinery has almost ceased to be a technical necessity and come to be a merely commercial convenience not for the consumer but for those deeply interested in the sugar business on a big scale. The refiner was until now the obligatory intermediary between producer and consumer. The product had forcibly to go through the refiner's hands, giving him thus the means to control and direct the world's sugar business to his liking and convenience. But technical progress, and the natural tendency to simplify production and to shorten the way between producer and consumer, cannot be retarded. Due to better technical methods, the producer all over the world is trying to get nearer the consumer to exclude the refiner or to make himself a refiner. It is therefore of the utmost importance to the producer to give his product, if not the same whiteness, by all means the same durability as the refinery does. In this respect the use of vegetable decolorizing carbons has brought a favourable change. Although the running costs of refining with their aid are still too high, the handling complicated and delicate, they reduce considerably the installation costs. Using vegetable carbons even a small factory can refine its own raw sugar. But, in pro-

ducing good white sugar, however refining is done, in a separate refinery or by the raw sugar factory itself, it has always until now been based on the usual system of the *two distinct stages*, i.e., producing raw sugar first and then remelting and refining it. These stages make it necessary to increase the capacity of the installations, in fact almost every section of the boiling house must be doubled. Remelting of the raw sugar and too much repeated reboiling of the resulting sugar solutions involve considerable losses and need much expensive labour. The ideal for sugar manufacture is undoubtedly the production of refined sugar *directly* out of beet or cane juice, excluding all unnecessary operations that otherwise would be duplicated. Producing refined sugar directly from the original juice on this basis will be almost the final step to perfect sugar manufacture.

POWER ALCOHOL FROM WASTE VEGETABLE MATERIALS (GRASSES, BEET PULP, ETC.). **A. C. Thaysen and L. D. Galloway.** *Annals of Applied Biology*, 1928, **15**, 392-407. It was established that the hemi-celluloses of various grasses, sisal hemp residues, beet pulp, etc., can be hydrolysed by acids to yield extracts fermentable by bacteria forming alcohol and acetone, as *Bac. acetoethylicus* Worth. Yields up to 22 gallons of acetone-alcohol mixture per ton of material were obtained, the acetone in this mixture being about 7 per cwt.—APPLICATIONS OF THE ELECTRICAL ASH METHOD. **E. Pelz.** *Deut. Zuckerind.*, 1929, **54**, No. 11, 261-262. This method has not received the appreciation it merits, though reliable apparatus for applying it is on the market. It gives immediately an insight into the progress of chemical and mechanical operations, reproducing results within 0·002, or at most 0·005 per cent. It is serviceable (in the beet factory) for determining the state of the water entering, especially when this is being re-used after purification. By using it for examining the juices in the several bodies of the evaporator, interesting figures in conjunction with those for the natural alkalinity and the calcium content are obtained. Then it is quite valuable for examining white sugars for their small content of mineral matter, the ordinary incineration process giving results that are much less accurate.—SAMPLING CANE STALKS. **W. E. Cross.** *Revista Ind. Agr. Tucumán*, 1928, **19**, 133-145. It is useless for the farmer to send in 1-5 stalks of cane expecting to have an analysis comparable with that of the first mill juice. A rule calculated to give results near the truth in sampling is to harvest a good number of stalks, count the number, weigh the lot, and obtain the average weight of each stalk. Twenty average stalks are selected to give a combined weight about 20 times the average figure, and these used as the average sample.—COST OF MAKING GUR. **Wynne Sayer.** *Imperial Department of Agriculture in India*, 1928. During a run of 16 days, 1483 maunds of cane were crushed in two small mills and 120 maunds of gur obtained (8·1 per cent.); the cost of this manufacture (including kerosene and other materials, and labour) was 279 Rs. It is shown that the nett value of 8·1 maunds of gur (selling price at 40 Rs. less cost of manufacture at 19 Rs.) is 22 Rs., and this taken from 29 Rs., the value of 100 maunds of the cane if sold to a mill leaves 7 Rs. as representing the nett loss per 100 maunds of cane if made into gur.—MAKING INVERT SUGAR FOR CONFECTIONERY. **A. A. Schaal and O. Johnson.** *Food Industries*, 1929, 266-269. 100 lbs. of sugar, and 33 of water are boiled up, tartaric acid added, boiling continued for 30 min., the invert syrup cooled, and finally neutralized. The tartaric acid should be such as is required to give a *pH* of 2·5, viz., 2-6 ozs. according to the buffering of the commercial sugar used.—CELLULOSE UTILIZATION FOR BOARDING MANUFACTURE. **H. A. Webber.** *Industrial and Eng. Chem.*, 1929, **21**, 270-275. Cornstalks, a great amount of which goes to waste in the U.S.A., might be used for making wall board, adjusting conditions so that as much as 90 per cent. of the original material is present in the finished boarding material. It is believed, however, that due to the increasing cost of wood pulp for paper making, cornstalk cellulose is very likely to find utilization also in that direction.—COMPARISON BETWEEN "CARBORAFFIN" 1928 TYPE AND "NORIT SUPRA 3X." **Koloman Reich and Gabriel Vavrinecz.** *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, **53**, No. 24, 285-289. Analyses give these figures for the two carbons respectively: Loss of weight at 150°C., 11·10; 12·73; ash, 2·98, 6·50; water-soluble ash, 1·57, 2·27 per cent.; Fe_2O_3, 0·34, 0·68; alkalies,

1·48, 2·00; silica, 0·83, 2·01 per cent.; reaction of the aqueous solution, neutral, alkaline; and inverting action (100 c.c. of 50 per cent. sucrose solution, 2 grms. carbon, ½ hour in water-bath at 90°C.), 58·6, 30·9 mgrms. of Cu per 50 c.c. As regards decolorizing power, factory runs with syrups using Daneks gave as colour removed, 39·4, 29·9 per cent., as the respective average figures after 49 hours. In charging Daneks of 13 sq. m. surface, the relative weights to obtain the same thickness of layer were 20 and 30 kg. Revivification was not attempted, the consumption of both carbons being so low, but by simply boiling up with water for an hour in the blow-up the "Carboraffin" could be regenerated to 50 per cent. of its original d.p., whereas the other carbon under the same treatment showed only a slight regeneration.—DETERMINATION OF ASH ELECTRICALLY. **B. G. Lava and F. G. Isaac.** *Sugar News*, 1929, **10**, No. 3, 186-189. Eleven samples of sugars from Philippine centrals were examined by the conductivity method, and the average c-ratio was found to be 1511 at 28°C., a value somewhat lower than that found by ZERBAN and SATTLER for sugars from different countries, viz., 1566·5. There is a difference between conductivity and incineration ash values, which can only be explained by assuming that the constituents of the ash are different in different centrals and at different seasons. The temperature coefficient of the conductivity of 5 per cent. sugar solutions is about 3·8 per cent. about 28°C., the average temperature in the P.I., but this value should be considered tentative.—SIMPLE VISCOMETER.[1] **A. E. Robinson.** *Industrial Chemist*, 1929, **5**, No. 52, 205-206. Molasses of other liquid under test is poured into the tube *A*; the steel ball ($\frac{5}{16}$ in. diam. weighing 2·048 grms.) placed in the holder *D* (1 in. diam., and 10 in. deep); a stop-watch held ready; the ball released and the watch started; and finally the time noted as soon as the lamp is lighted owing to the ball making contact with the brass strips at *C*. An empyrical figure for the "viscosity seconds" is thus obtained, which may be compared with the value for a solution of sucrose of the same density or sugar content as the liquid examined. Originally designed for the examination of cellulose lacquers, this instrument should prove quite useful for syrups, molasses, etc., in the sugar industry.—PROPERTIES AND CHEMICAL CONSTITUTION OF GLUCIC ACID. **E. K. Nelson and C. A. Browne.** *Journal of the American Chemical Society*, 1929, **51**, 830-836. The unstable calcium salt of an acid, originally described by WINTER[2] under the name of glucic acid, was prepared by the action of calcium hydroxide upon dextrose in aqueous solution at 67° in the absence of air. The precipitated calcium compound absorbed oxygen rapidly from the air with decomposition and evolution of heat. The unstable calcium salt, after decomposing with sulphuric acid and extracting with ether, yielded a small amount of crystallizable unsaturated acid, corresponding to the formula $C_3H_4O_3$, which from its strong reducing power, iodine absorption and other properties is in all probability the enolic form of the semialdehyde of malonic acid. The crystalline acid can be partially sublimed without decomposition but undergoes upon heating a considerable degree of polymerization. It yields formic and oxalic acids upon oxidation and is exceedingly unstable in the presence of organic impurities.



CENTRIFUGAL CLARIFICATION. **R. H. Hurst.** *Tropical Agriculture*, 1929, **6**, No. 4, 112-113. Small scale experiments were made in the laboratory of the Usine Ste. Madeleine, Trinidad, with a Hamill centrifugal (3000 r.p.m.) and a Sharples supercentrifuge (36,000 r.p.m.), using syrup and *B*-molasses heated to 90°C. A definite increase of purity particularly on supercentrifuging was indicated (using the refractometric Brix). The sludge removed from the syrup was 0·32 and 0·31 per cent. respectively by the two machines, whilst the figures for the *B*-molasses were 0·16 and

[1] Protected by Provisional Patent No. 10,118 of April 2nd, 1929.
[2] *Z. Ver. Rubenzuckerind.*, 1894, 44, 1049.

4·23. The Hamill centrifuge was relatively more effective with syrup than with the much more concentrated and more viscous molasses. Using this machine, sludges were obtained which after washing contained 58·13 and 41·54 per cent. of ash. The higher the concentration of the material, the greater the removal of colloidal substances, though this was limited by the viscosity. Viscosity determinations indicated very clearly the value of the process, though surface tension measurements failed to give indications (probably due to oil contamination). These laboratory results indicate the possibilities of centrifugal clarification in practice, alone or in conjunction with a filtration scheme, though it must be borne in mind that the maximum speed which then could be applied would be 800 to 1000 revs. per min.—EXTENDED STEAM TABLES. **H. L. Callendar.** *Institution of Mechanical Engineers*; *Report Ref. J/T 40 received from the British Electrical and Allied Industries Research Association.* These important tables relating to the properties of saturated steam are : (1) temperature basis, 200 to 380·5°C., and 400 to 717°F. in foot-pound Centigrade and Fahrenheit units. (2) Pressure basis, 400 to 3200 lbs. per sq. in. for both C. and Fah. units. Below 200°C. and 400° F. the extended tables agree so closely with the old tables that it was not necessary to repeat the calculations. The small differences at 200°C. from the old tables are due almost entirely to the new determination of the small constant *b*, which has now been determined by experiments at the critical point, whereas it could not be determined satisfactorily from the old observations at low pressures.—BRITISH GUIANA CANE SUGAR INDUSTRY. **Maurice Bird.** *Empire Production and Export*, 1929, No. 148, 290-297. This is a general article on the Demerara sugar industry, dealing with its history, agriculture and technology. The very stiff clays of the sugar estates have when dry the characteristic greasy feel of magnesium silicate, and the economical removal of magnesia can in the author's opinion be accomplished most efficiently by incorporation with humus as in green manuring, so that when this is aided by suitable drainage and deep tillage, the magnesia is washed away as carbonate, also with soda and waste material, making an ideal soil. The tractor plough is now the order of the day on several estates, which are rewarded with a markedly increased yield. HARRISON's Demerara seedling 625 has been the predominating cane of the colony for over 20 years, while the following are also cultivated, though more as understudies than rivals : D 337, D 666, D 84, D 419, and D 695. On the manufacturing side, great improvements have been made during the past decade in the way of modernizing and enlarging the mills. Continuous settlers of the Dorr type and the conical subsider of the C. S. R. Co. have increased quality and yield. MULLER's superheat process[1] has been stopped due to the great corrosion of juice-heater tubes and pumps by this method. An experiment of clarifying with Bauxite is now being made. On the whole, the more progressive factories obtain a remarkably good recovery considering the rather poor quality of much of the juice, due to soil alkalinity. Rum though not enjoying the market of former days is still the most important by-product, and alcohol motor spirit is exported in specially constructed tankers. " Molascuit " is still used locally, and exported. Enormous expansion of the industry is feasible.—HAND REFRACTOMETER. *Communicated by the Manufacturers.* This instrument can be used with daylight or with a suitable lamp, and is provided with a scale having numbers from 1 to 120, corresponding to refractive indices from 1·33300 to 1·34700. It is calibrated for 20°C.; in order to allow for temperatures other than this, a sensitive thermometer is read at the moment of observation, and the appropriate correction as given by tables applied. Dispersion can be easily compensated by the observer while measuring, giving a border-line which can be sharply distinguished. It is suitable for use in the sugar factory or refinery, where measurements accurate to 0·25 per cent. can be obtained. It costs about £17. J.P.O.

[1] *I.S.J.*, 1924, 276.

Review of Recent Patents.[1]

UNITED STATES.

Rotary Cutter for Cane Mills. Ira Merlis (assignor to the Kelvin Engineering Co., Inc., of New York). 1,695,196. December 11th, 1928.

Rapidly revolving, rotary cutters are used transversely of the carrier, in which a series of staggered knives carried by a rapidly rotating shaft are caused to cut into the stratum of stalks as these move toward the mill, thus making the feed more uniform, and in better shape for the crushers and mills. *A* represents a shaft which is journalled transversely of the carrier *B*, which carrier is provided with the usual slatted conveyor *B'*. This shaft may be driven in any convenient way, as by means of a steam turbine *C*, for instance of the De Laval type. Keyed on this shaft are a series of knife holders arranged in staggered relation, and carrying the knives *E*. These holders are carried by housing blocks *F*, having a hub portion and oppositely

Fig. 1.

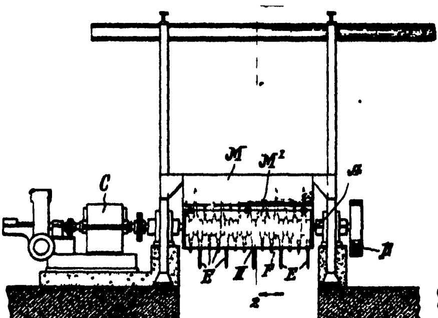
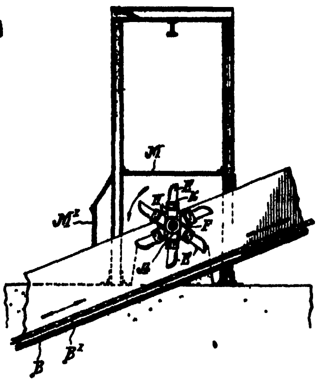


Fig. 2.



disposed jaws. The housing blocks are slipped over the shaft and held thereon in staggered relation, and the diverging arms are perforated to receive a plurality of bolts or rivets which may be held in place by lock nuts, or may be rivetted. Mounted between the jaws on opposite sides of the housing blocks *F* are the knife holders proper *H*, to which the knives are attached, as by means of bolts or rivets. Each knife may be attached directly to the knife holder, but in order to reinforce the shank of the knife, washers may be provided. The shanks of each of the knife holders *H* are perforated to receive a bushing which may be of rubber, through which bushing bolts may be conveniently inserted. Thus a yielding bearing is provided for the base of the knife holder, which will yield when lateral or twisting strains are impressed upon the knife. Each housing block is provided with a pair of knife holders, carrying oppositely disposed knives. The number of these holders on the housing block would depend on the carrier. On a 7 ft. carrier, there would be about forty of the knives, arranged in staggered relation, so as to make the cutting more uniform and to distribute the load on the driving mechanism, this distribution of the load being also assisted by having a flywheel of suitable weight. The motor should be of sufficient power to rotate the shaft carrying the knives at a speed of from 200 to 600 revs. per min. The knives are maintained in normal planes at right angles to the axis of the said shaft, and when striking a glancing blow, the rubber bushings yield laterally in either direction, and hence the hub end of the knife is free to move laterally on the

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

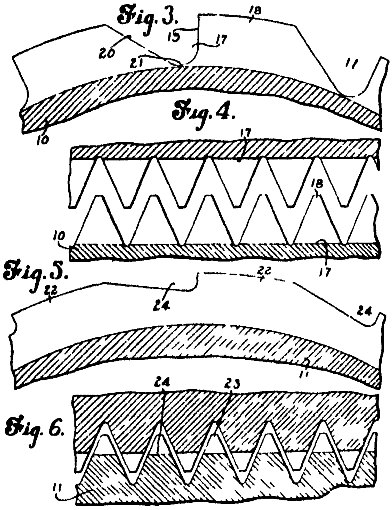
U.S.P., 1,119,176; *I.S.J.*, 1915, 291.

elastic bushing. The knives actually float on the bushing, and consequently, the lateral bending stresses are reduced to such an extent as not to subject the knife to any destructive lateral bending or twisting stresses which cause breakage of knives in the ordinary rigid type of construction. With the construction herein described, a twisting motion of the knife is effected under lateral torsional stress occasioned by the knife approaching the cane stalks at different angles, these stalks lying in almost every conceivable direction on the carrier.

— —

CANE MILL. **Franklin Farrel, Jr.** assignor to the **Farrel-Birmingham Co., Inc.,** of Ansonia, Conn.). 1,696,944. January 1st, 1929. (Filed June 27th, 1924; serial No. 722,749).

In a cane mill claim is made for a combination of parts as illustrated in the following example: A pair of preliminary crusher rolls, are followed by a second pair of crusher rolls that deliver the crushed cane to a juice-expressing three-roller mill. The rolls of the crushers are provided with teeth for hooking or drawing in the cane, and with a plurality of circumferential V-shaped grooves. This provides correspondingly shaped ridges or ribs, and the ribs of one roll of the pair enter to a certain extent the grooves of the other roll with a certain amount of clearance, as shown in Fig. 4. The circumferential grooves are intersected by generally longitudinal grooves 17, the result of which intersection is the formation of the teeth 18, as shown in Figs. 3 and 4. Each of the longitudinal grooves 17 has an abrupt side 19, a sloping side 20, and a rounded bottom 21, as shown in Fig. 3. While the grooves 17 are longitudinal in a general sense, they are preferably not exactly parallel to the axis of the roll; in fact, it is considered the best practice to provide an obtuse angle in the lengthwise groove. In the second crusher, the grooving is substantially as follows: Teeth 22 in Fig. 5 are formed by the provision of circumferential and longitudinal grooves in generally the same manner described with reference to the rolls 10. The circumferential grooves of the second crusher are shown at 23 in Fig. 5 and the longitudinal grooves at 24. It will be noted, however, that whereas in the case of the rolls 10, the longitudinal and circumferential grooves are of substantially the same depth, the longitudinal grooves of the second crusher are of substantially less depth than the circumferential grooves thereof. In the first crusher, the circumferential grooves are, say, $\frac{1}{32}$ of an inch deeper than the longitudinal grooves in order to insure the scraper points of usual construction (not shown) reaching fully to the bottoms of the longitudinal grooves and thereby cleaning the same out thoroughly. In the second crusher, however, instead of having the longitudinal and circumferential grooves of substantially the same depth, the longitudinal grooves 24 should not have more than three-quarters of the depth of the circumferential grooves 23, and preferably less than that. The best results are obtained by cutting the longitudinal grooves to a depth of approximately one-third of that of the circumferential grooves, as shown in Figs. 5 and 6. In the second crusher, owing to the condition of the cane as received from the first, less drawing or hooking-in effect is necessary. On the other hand, it is desirable to increase the shredding action and the juice-expressing action. This is realized in this improved crusher by arranging the grooves in the manner described. Cane stalks supported in the shallow lengthwise grooves of a roll at a plurality of spaced points, are carried by a sort of wiping motion down into relatively



24

deep valleys of said roll by the circumferential ribs of the other roll. This so-called wiping motion has the effect of tearing apart the cane stalks and shredding them effectively, separating the fibres thereof, and at the same time the squeezing or juice expressing effect is increased by the fact that portions of the stalk are forced or wedged down into the bottoms of the valleys, by and simultaneously with the wiping action of the circumferential ribs. The best results are obtained in a mill of this character where the pitch of the circumferential ribs of a preceding pair of crusher rolls is the same as the pitch of the circumferential ribs of a following pair. It is preferable, in an installation such as described, to have the spacing of the longitudinal grooves 24 of the following crusher the same as that of the longitudinal grooves 17 of the preceding crusher.

PRODUCTION REVIVIFICATION AND APPLICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Arthur B. Ray, E. G. Doying and John J. Butkovsky** (assignors to **Carbide and Carbon Chemicals Corporation**, of New York). 1,694,040. December 4th, 1928. (*B*) **Edouard Urbain** (assignor to the **Urbain Corporation**, of Delaware, U.S.A.). 1,700,342. January 29th, 1929. (*C*) **Emil F. Scheller**, of Lorsbach-in-Taunus, Germany. 1,704,765. March 12th, 1929.

(*A*) A process of making dense strong activated charcoal comprises impregnating nut cellulose with phosphoric acid, heating the mixture to a temperature not materially below 350°C., passing steam over the heated material to carry off volatile phosphorus compounds, recovering phosphorus compounds from the steam and returning the phosphorus compounds to the process. (*B*) As a new product, a paste comprising decolorizing carbon and a liquid which are thoroughly mixed together by grinding. (*C*) An activated carbon is produced by the interaction of sodium monoxide and carbonaceous material and is characterized by the fact that 0·1 grm. of it will produce a decolorization of 60 per cent. in 100 c.c. of standard molasses solution as described.

PRECIPITATION APPARATUS. **Ralph W. Shafor, Alpheus R. Nees, and Robt. J. Brown**, of Denver, Colo., U.S.A. 1,708,332. April 9th, 1929. Apparatus for the precipitation of precipitable substances from their solutions comprises in combination a vessel adapted to contain a diluent bath and having an overflow to maintain a determinate volume of said bath by the discharge of surplus liquid, the vessel being divided into a mixing zone and a precipitation zone communicating in the lower portion of the same, means in the mixing zone adapted to produce a current circulating from the mixing zone downwardly into the precipitation zone, means to feed solution into the bath in the mixing zone, and means to subject the bath in the lower portion of the precipitation zone to a precipitating heat.—CANE CUTTER. **Lee Ankenbauer**, of Strawn, Texas, U.S.A. 1,708,350. April 9th, 1929. In a cane cutter, claim is made for the combination of runners spaced apart, a platform on the runners, a guide arm diagonally spaced apart from one of the runners, a plate spanning the guide arm and one of the runners; said plate having a V-shaped cut-away portion terminating in a recess, and including cutting edges, a revolvable star shaped wheel adjacent the recess for assisting the cutting operation.—REGENERATION OF KIESELGUHR. **Alphonse M. Duperu**, of Crockett, Cal., U.S.A. 1,708,362. April 9th, 1929. A method of regenerating moist kieselguhr cake which has been used as a filter aid, consists in thoroughly mixing the cake with finely divided dry kieselguhr to give it a " mealy " consistency, thereafter passing the mixture through a drying kiln in which the moisture is driven off from the kieselguhr, then passing said dried kieselguhr through means to reduce it in fineness, thereafter delivering it to a burning kiln, in which it is agitated by air and in which kiln the associated organic matter is burned from the kieselguhr particles, then recovering the dust from the drying and burning kilns by gathering the dust in water and thereafter mixing the water carrying the suspended dust with dry, calcined kieselguhr from the calcining kiln and thereafter filtering the mixture by means of which the kieselguhr may be separated from the surplus water and washed previous to re-use.

UNITED KINGDOM.

PURIFICATION OF SACCHARINE LIQUIDS (MANUFACTURE OF WHITE SUGARS FROM RAWS). **Hermann Wiese and The Anglo-Scottish Beet Sugar Corporation, Ltd.**, of Glasgow, Scotland. 308,529. June 21st, 1928.

It is common practice to affine raw sugar in centrifugal machines by mixing the same to a magma with syrup obtained from a previous charge, and thereafter washing the sugar in the centrifugal machine with water, the syrup obtained from the wash water being used as mixing syrup for a succeeding charge of raw sugar. The practice has been to concentrate the affination syrup produced to a massecuite and treat it in centrifugals, yielding a proportion of impure sugar which re-enters the process with the raw sugar, and a residue of molasses which is discarded. According to the process described in a prior patent[1] granted to H. WIESE, the affined sugar is dissolved in water and mixed with a proportion of lime; the mixture is saturated with carbon dioxide, heated and filtered; the filtrate is again mixed with a small proportion of lime, again carbonated, heated and filtered; the second filtrate is then saturated with sulphur dioxide, heated and filtered, and the resulting filtrate is ready for concentration to yield white sugar.[2] The present improvement consists in mixing the impure affination syrup having an acid reaction with a proportion of the residual cake from a previous saturation, i.e., the first, second or third saturation mentioned above, heating the mixture to about 180°F. (82°C.) and filtering. The filtrate obtained is found to be neutral, free from mechanical impurities and yields a superior raw sugar. It also yields a superior molasses. Owing to the purification effected, the yield of refined sugar is increased, while the amount of final molasses is reduced. Similarly, the affined sugar solution is mixed with another quantum of cake obtained from one of the saturations, heated to 180°F. (82°C.) and filtered, thereby rendering it neutral and removing solid impurities. The filtrate may be subjected to a single addition of lime, followed by saturation with carbon dioxide, heating and filtration, succeeded by a further saturation with sulphur dioxide followed by heating and filtration. The end result is a saving in the total quantity of lime required, easier work at the saturations, and superior work at the filters, due to the absence of solid or semi-colloidal substances. Further, it is found that with the use of cake as described above either the saturation with carbon dioxide or the saturation with sulphur dioxide can be omitted. It has previously been proposed to treat beet juice with lime and neutralize with monocalcic phosphate followed by addition of powdered limestone and filtration, the residue from the filtration being used in place of the limestone in subsequent operations. It has also been proposed to employ bibasic calco-carbonic sucrate and also a crystallized hydrated carbonate of lime formed by passing carbonic acid gas into a syrup which has been strongly limed and kept at a low temperature.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **R. Defris and R. Walder**, of Vienna, Austria. 303,669. February 7th, 1928. (*B*) **I. G. Farbenindustrie A.-G.**, of Frankfort-on-Main, Germany. 306,490. February 20th, 1929; convention date, February 21st, 1929.

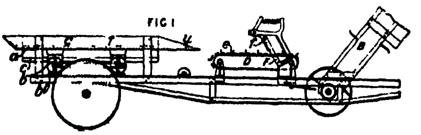
(*A*) Briquettes, manufactured by compressing carbonaceous material with a suitable binder, and subsequent carbonization and activation, are made in such a way that during carbonization or activation there is formed in the material a system of macro-capillaries which traverse the material in the manner of veins. The macro-capillaries afford a ready admission of the gases to the interior of the mass so that activation becomes perfectly homogeneous. This heterogeneous capillary structure of the briquetting mass may be produced by a mechanical process such as pulling and drawing to thin filaments, which are subsequently woven together. It may also be produced by mixing the raw briquetting material, which may be a mixture of charcoal and tar or pitch, with animal hairs or other natural or artificial fibrous materials, e.g. cotton, silk, artificial silk or other organic substances. On carbonizing, these

[1] U.K. Patent, 12,642 of 1911. [2] Cf. MEYER., *I.S.J.*, 1927, 501; 1928, 564.

fibrous materials leave hollow spaces throughout the mass, and the activation is then more rapid and efficient. By means of this process raw materials may now be used, such as waste coal, which hitherto could not be used for the manufacture of highly activated carbon. (*B*) Activated carbon is prepared from disintegrated wood such as wood chips or sawdust by soaking it for a long time with stirring, or boiling it in a solution of zinc chloride, phosphoric acid or other activating agent, and then drying and igniting. A further saturation, with a cold solution of the agent, may be employed before ignition. In a modification, the wood is first boiled in water to cause swelling and then soaked in a hot or cold solution of the activating agent. In an example, birch sawdust is boiled for 4 hours in a 50 per cent. solution of zinc chloride, drained, again soaked in a 50 per cent. solution of zinc chloride, and after drying in an oven is finally ignited at 600-750°C.

PROCESS OF STRIPPING PALM FRUIT FROM STALKS. **Rubber Cultuur Mij.**, Amsterdam. 305,042. January 28th, 1929; convention date, January 28th, 1928. Bunches of palm fruit are fed through a hopper into a frame carrying a number of inclined rotating drums. These drums which are preferably in the form of polygons having many sides and with rounded corners, impart a rapid rotating movement to the bunches and cause the fruits to be torn off by centrifugal force. The fruit passes between the drums and through side gratings and falls into the space below the drums. The stalks move down the slope of the drums and are discharged at the lower end. (Specification 217,678 is referred to.)—FERMENTATION FOR ALCOHOL, AND ACETONE PRODUCTION. **Commercial Solvents Corporation**, of Terre Haute, Indiana, U.S.A. (assignees of **M. C. Wheeler and D. de L. Goodale**). 306,138. February 11th, 1929; convention date, February 17th, 1928. Carbohydrates are fermented by the butyl-acetonic fermentation for the production of *n*-butyl alcohol, acetone and ethyl alcohol in a continuous manner in a number of fermenters connected in series while adding fresh mash to the first of said fermenters and removing fermented mash from the last member of the series. An amount of partially fermented mash equivalent to the fermented mash removed from the last fermenter is transferred from each preceding fermenter into the next succeeding fermenter. The fermenters may be on the same or different levels, and agitation devices may be provided to break up and disperse the "head" formed through the fermenting medium just before the latter is discharged from a fermenter.—PREVENTING INCRUSTATION. **A. Heinrich**, of Charlottenburg, Berlin. 306,145. February 14th, 1929; convention date, February 17th, 1928. Deposit of scale in boilers, etc., is prevented by connecting the boiler to earth, and also connecting the upper part of the boiler to one or several metallic points projecting into the air, or to an aerial wire which is placed, if possible, parallel to power wires in the neighbourhood. SUGAR AND ALCOHOL FROM WOOD (PRODUCTION OF HYDROCHLORIC ACID GAS). **International Sugar and Alcohol Co., Ltd. (Soc. Industrielle de la Cellulose,** of Geneva). (*A*) 307,985; (*B*) 307,986. December 21st, 1927. (*A*) In preparing HCl gas from aqueous hydrochloric acid by heating with calcium chloride, the residue of calcium chloride is subjected to reduced pressure, whereby water is distilled and the temperature is reduced ready for use again. (*B*) HCl gas is obtained by heat in aqueous hydrochloric acid with sulphuric acid of about 70 per cent. strength in stages of successively increased temperature.—SUGAR PRODUCTION FROM CELLULOSE. **A. Classen**, of Aachen, Germany. 307,998. December 31st, 1927. Sugar solutions such as those obtained by opening up cellulose-containing substances freed from even slight quantities of hydrochloric acid by distillation, preferably in a vacuum, in the presence of specifically heavier inert organic liquids such as tetrachlorethylene. Any minute quantities of hydrochloric acid left behind are neutralized by sodium bicarbonate.—PURIFICATION OF BEET SYRUP. **K. Komers and K. Cuker**, of Tavikovice, Moravia. 308,031. February 1st, 1928. Diffused sugar syrup is purified by a temporary oxidation by means of air at ordinary or slightly elevated temperatures, whereby a dark coloration is produced. The syrup may be led over a screen to ensure complete contact with the air or the air may be blown through the syrup for a few minutes. The dark coloration is

removed by the addition of bases such as lime or other calcium salts, care being taken to avoid the decomposition of the precipitate by excess of lime. Superphosphate may also be used for precipitation, in which case, after removal of the precipitate the syrup is rendered basic with lime. The steps are repeated until darkening no longer results on oxidation.—HARVESTING SUGAR BEET. **E. C. Stubbs**, of Whiston, near Penkridge, Staffs. 308,287. December 16th, 1927. In a machine adapted to be drawn along behind a vehicle to which it delivers sugar-beet or other roots from an elevator *B* which is fed by a conveyor *D* to the rear of the elevator, a topping-knife *F* is arranged at one or both sides of the conveyor. The knife may be a rigid blade or rotary disc or, as shown, a flexible blade mounted in a holder, and slanted forwardly and downwardly.



The roots are placed by hand in the angle-bars *e* of the conveyoe and are held down while they are topped by a spring-pressed bar *f*. The roots are lifted from the ground on to a conveying and cleaning device *C* which comprises side walls *T* and alternate fixed and movable bars, the latter rising intermittently between the fixed bars U with a forward movement so that the roots are shaken and conveyed to the end of the fixed bars which project beyond the movable bars. The latter are actuated by two crankshafts and may be in two or more sets *a*, *c* actuated by cranks *b*, *b'* arranged at different angular positions on the shafts. The conveyors and elevator are driven by a motor (not shown) placed beneath the elevator.—INSECTICIDES. **I. G. Farbenindustrie A.-G.**, of Frankfort-on-the-Main, Germany. 308,661. March 25th, 1929 ; convention date, March 24th, 1928. Insecticides, suitable for destroying weevils and green fly, consist of ethylene oxide in admixture with carbon tetrachloride or other inert diluents, solvents, or irritants. A very low concentration of the vapour is stated to be effective. The use of carbon tetrachloride, carbondisulphide, and ethylene chloride as insecticides is referred to.—CRYSTALLIZING SUGAR. **Batavier Corporation**, of New York, U.S.A. (assignees of **C. A. Spreckels**, also of New York, U.S.A.). 308,686. March 22nd, 1929 ; convention date March 26th, 1928. In refining sugar, solutions are concentrated and caused to crystallize by blowing air or other gas through them at a temperature sufficiently low to avoid loss by inversion or caramelization of the sugar. Raw sugar is mixed with syrup or sugar liquor in a mingler to form a pasty mass which is passed to an aerator, in which air or other gas is forced through it, thereby agitating the sugar crystals vigorously, freeing them from particles of ash, from molasses and other impurities, and causing evaporation of moisture. The temperature of the aerator should preferably be below 180°F. Fresh syrup may be added to the mass in the aerator as the sucrose in the liquid crystallizes out. When crystals of the required size have been obtained they are separated by a centrifugal machine, with or without the addition of small quantities of wash-water. The liquid separated contains substantially no crystallizable sugar ; the washed sugar is dissolved in water or dilute sugar solution in a melter. After filtration in the usual presses the sugar is crystallized in a second aerator and separated by a centrifugal machine. Syrup from any suitable source may be added to the aerator to maintain the sucrose content of the liquor.—EVAPORATOR. **Aktiebolaget Separator**, of Stockholm, Sweden (assignees of **F. H. McBerty**, of Poughkeepsie, New York). 308,727. March 25th, 1929 ; convention date, March 27th, 1928. Liquids are evaporated by causing them to flow in a thin film over a heating surface while subjected to the action of centrifugal force and reduced pressure. Liquid entering by a pipe passes through a pre-heating coil inside a steam chamber. The upper end of the coil is connected to a pipe which delivers the hot liquid tangentially on to the inner surface of a chamber in which a partial vacuum is maintained. A spiral baffle assists in causing the liquid to flow in a thin film over the heated surface of the chamber. The vapourized liquid and the residue passes out. In an alternative form, the chamber contains a rotating vaned member to distribute the liquid.

Sugar Crops of the World.

(Willett & Gray's Estimates to May 23rd, 1929.)

	Harvesting Period.	1928-29. Tons.	1927-28. Tons.	1926-27. Tons.
United States—Louisiana	Oct.-Jan.	145,000	63,207	42,112
Porto Rico	Jan.-June	550,000	670,831	562,679
Hawaiian Islands	Nov.-June	830,000	807,180	724,403
West Indies—Virgin Islands	Jan.-June	7,500	10,562	7,077
Cuba	Dec.-June	5,218,428	4,011,717	4,504,716
British West Indies—Trinidad	Jan -June	75,000	81,551	51,982
Barbados	„ „	55,000	67,375	58,685
Jamaica	„ „	65,000	67,350	65,280
Antigua	Feb.-July	11,000	19,811	23,501
St. Kitts	Feb.-Aug.	15,000	19,443	18,068
Other British West Indies	Jan.-June	5,000	6,141	4,969
French West Indies—Martinique	Jan.-July	40,000	41,879	45,039
Guadeloupe	„ „	4,000	33,462	35,673
San Domingo	Jan.-June	345,000	368,196	303,524
Haiti	Dec.-June	16,000	16,367	12,563
Mexico	„ „	170,000	175,214	181,858
Central America—Guatemala	Jan.-June	32,000	28,792	32,432
Other Central America	„ „	60,000	67,129	78,740
South America—				
Demerara .... Oct.-Dec. and	May-June	109,000	114,609	97,425
Surinam	Oct. Jan.	15,000	13,500	16,669
Venezuela	Oct.-June	20,000	19,915	20,230
Ecuador	June-Jan.	22,400	20,091	20,321
Peru	Jan.-Dec.	345,000	374,852	375,963
Argentina	May-Nov.	375,329	421,601	475,695
Brazil	Oct.-Sept.	675,000	650,000	850,565
Total in America		9,205,657	8,170,775	8,610,169
British India	Dec.-May	2,735,000	3,216,000	3,255,000
Java (1929-30 2,984,000)	May-Nov.	2,939,164	2,360,079	1,991,390
Formosa and Japan	Nov.-June	750,000	692,932	523,054
Philippine Islands	„ „	637,000	622,704	584,238
Total in Asia		7,061,164	6,891,715	6,353,682
Australia	June-Nov.	532,034	493,049	415,611
Fiji Islands	„ „	108,000	95,114	69,071
Total in Australia and Polynesia		640,034	588,163	484,682
Egypt	Jan.-June	96,000	92,000	71,553
Mauritius	Aug -Jan	225,000	215,555	192,590
Réunion	„ „	52,000	* 49,972	56,579
Natal (1929-30 267,000)	May-Jan.	264,285	219,642	216,305
Mozambique	„ Oct.	65,000	73,000	63,970
Total in Africa		702,285	650,169	600,997
Europe—Spain	Dec.-June	....	9,000	6,719
Total cane sugar crops		17,609,140	16,309,822	16,056,249
Europe—Beet sugar crops		8,315,300	8,031,874	6,871,892
United States—Beet sugar crop †	July-Jan.	928,253	965,241	801,246
Canada—Beet sugar crop †	Oct.-Dec.	28,857	27,212	31,422
Total beet sugar crops		9,272,410	9,024,327	7,704,560
Grand total Cane and Beet Sugar	Tons	26,881,550	25,334,149	23,760,809
Estimated increase in the world's production	„	1,547,401	1,573,340	*845,733

* Decrease.
† Refined Sugar.

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to May 25th	1,774,985	..	1,497,456
Deliveries " "	1,497,982	..	1,210,659
Meltings by Refiners " "	1,250,709	..	1,084,300
Exports of Refined " "	40,000	..	40,213
Importers' Stocks, May 25th	375,234	..	395,337
Total Stocks, May 25th	687,231	..	550,942
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT APRIL 30TH.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	1,517,594	..	1,324,049	..	1,872,581
Stocks	1,449,624	..	1,316,618	..	1,509,795
	2,967,218		2,640,667	..	3,382,376
Local Consumption..	36,000	..	35,970	..	28,377
Receipts at Ports to April 30th ..	3,003,218	..	2,676,637	..	3,410,753

Habana, April 30th, 1929. J. GUMA.—L. MEJER.

Beet Crops of Europe.

(Willett & Gray's Estimates to May 23rd, 1929.)

	Harvesting Period.	1928-29. Tons.	1927-28. Tons.	1926-27. Tons.
Germany	Sept.-Jan.	1,830,000	1,655,450	1,657,088
Czecho-Slovakia	Sept.-Jan.	1,050,000	1,253,163	1,043,259
Austria	Sept.-Jan.	110,000	110,020	79,498
Hungary	Sept.-Jan.	220,000	187,600	173,470
France	Sept.-Jan.	890,000	863,206	729,082
Belgium	Sept -Jan.	280,000	273,113	233,421
Holland	Sept.-Jan.	320,000	259,966	287,427
Russia (Ukraine, etc.)	Sept.-Jan.	1,380,000	1,501,986	871,020
Poland	Sept.-Jan.	740,000	566,515	552,553
Sweden	Sept.-Dec.	160,000	145,335	20,871
Denmark	Sept.-Jan.	170,000	142,800	151,119
Italy	Aug.-Oct.	380,000	284,276	313,738
Spain	July-Feb.	238,000	259,964	284,387
Switzerland	Sept.-Jan.	7,300	6,550	7,950
Bulgaria	Sept.-Jan.	30,000	42,368	31,485
Roumania	Sept.-Jan.	120,000	139,522	162,821
Gt. Britain and Ireland†	Sept.-Jan.	223,000	208,114	165,465
Jugoslavia	Sept.-Jan.	127,000	77,967	78,770
Other Countries	Sept.-Jan.	40,000	43,959	28,468
Total††		8,315,300	8,301,874	6,871,892

† Refined Sugar.
†† European Beet Crop Figures are furnished principally by F. O. Licht.

United Kingdom Monthly Sugar Report.

Our last report was dated May 10th, 1929.

Markets generally have gone from bad to worse and values have reached a level which have not been experienced since 1902, when 88 per cent. beet, f.o.b. Hamburg sold as low as 5s. 10½d. per cwt.

A general nervousness prevails amongst the whole trade, who continue to sell sugar whenever possible, and the speculator has become so tired of losing money that sentiment on all sides is not in favour of the article.

New records have been registered in the White Terminal Market section. Prices have been flat and declining. May sold down to 9s. 4½d., August from 10s. 6d. to 9s. 6d., December at 10s. 9¾d. to 10s. and March from 11s. 3¾d. to 10s. 6d.

The Raw Terminal Market has been equally depressed owing to the liberal offers of Raws from Cuba.

About 3000 tons of Polish 88 per cent. beet were tendered on May, and the price fell to 7s. 9d., but finally closed at 7s. 10½d. August fell from 8s. 1½d. to 7s. 3d., and recovered to 7s. 4½d. December moved from 8s. 6d. to 7s. 9d. to 7s. 10½d., March from 8s. 9d. to 8s. to 8s. 1½d., May from 9s. to 8s. 3d. to 8s. 4½d. The latest prices are :—

	AUGUST		DECEMBER		MARCH		MAY
White	9s. 5¼d.	..	10s. 0d.	..	10s. 6d.	..	10s. 9d.
Raw	7s. 3¾d.	..	7s. 9¾d.	..	8s. 0d.	..	8s. 3¾d.

Dealings in actual sugar have been small and mostly confined to British Refined and Home Grown. Refiners made two reductions during the period under review : 3d. per cwt. on May 22nd and a further 3d. on June 4th, the latest prices being No. 1 Cubes 25s. 3d., London Granulated 22s. 1½d.

Prices for Home Grown have fallen more than British Refined, the latest prices being 21s. 4½d. to 21s., according to factory, less the usual 4½d. rebate.

Continental sugar has been easier. Czecho Granulated is offering at 10s., whilst German Granulated sold down to 9s. 6d. Dutch on the other hand maintained their price at a higher level of 10s. 3d.

A fair business has been done in Raws from 8s. 9d. down to 8s. c.i.f., whilst some small parcels afloat sold as low as 7s. 9d. c.i.f.

The American market has fallen although Cubans have not been sold under 1¾ ; duty free sugar sold at 1$\frac{11}{16}$. The Future's market has fallen about 20 points.

With regard to Europe there is little to report. F. O. LICHT's second estimate for sowings varies only slightly from his first one.

The Cuban production to date is given as 5,140,000 tons, whereas exports are already 900,000 tons more than last year. The stock in the Island still continues to be about 250,000 tons higher than a year ago.

21, Mincing Lane,
London, E.C.3.,
June 10th, 1929.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE INTERNATIONAL SUGAR JOURNAL.

All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 367. JULY, 1929. VOL. XXXI.

Notes and Comments.

The Political Outlook.

The advent of a Labour Government in Great Britain has naturally led to a feeling of uncertainty as to the imminence of more or less drastic changes in the economic and fiscal order as regards Empire trade and in particular as regards sugar. We have to write this at a moment when the Government have just started to unfold their preliminary plans, and before these have been fully disclosed and discussed in the usual debate on the King's Speech to Parliament, but it seems clear that the new Government, whatever their ultimate aims, have no intention of acting precipitately and upsetting trade and industry just when these are showing signs of permanent revival. So neither the McKenna duties nor those on Safeguarding seem destined for extinction without a careful enquiry, and in any event not before Mr. SNOWDON unfolds his first main Budget next Spring. By that time it may be assumed that the pros and cons of leaving existing duties to continue will have been thoroughly sifted; and if the Government then do decide against them it will indicate that the employment these are supposed to ensure to labour is not deemed commensurate with the political disadvantages of protecting certain industries in defiance of well-known party tenets.

As regards sugar, we think it may be assumed that the same premises as outlined above apply equally. These will continue till the end of the present fiscal year next Spring, and then we shall learn doubtless whether the idea of the free breakfast table is paramount, or whether Mr. J. H. THOMAS's investigations into the problem of curing unemployment, which it appears are to include a survey of the requirements of the Empire in the matter of labour, are to be given a broader interpretation than a strict adherence to doctrinaire free trade would suggest. The fact that Mr. THOMAS (who as Lord Privy Seal is responsible for tackling the unemployment problem) is bent on seeing what the Empire can do in the matter suggests that he at all events will discourage the idea that it does not matter whether or not Empire industry is robbed of its present incentive to producing sugar and thereby giving employment. On the contrary, if the Empire is to be asked to assist the home country by finding employment for its excess workers, the Empire may well stipulate that its present trade and industry and thereby its own labour problem shall not be jeopardized by the arbitrary loss of existing preferences in the Home market.

So while the fiscal outlook for British sugar production is at the moment somewhat uncertain and may remain so possibly till next Budget day approaches, it seems quite unnecessary to take alarm and assume that a *volte-face* is contemplated by the Labour Government. Nor need it be considered a foregone conclusion to come to that the present advantages the home refiners hold in the U.K. market will be lost. It of course hangs on the present sugar duties which may conceivably be altered next year. But the Government will doubtless take care to ascertain beforehand whether the alteration is likely to result in any marked increase in unemployment at home. The curing of unemployment is to be their trump card for the present, so it would be surprising if they lightly took steps that would be bound to lead to further unemployment.

British West Indian Claims.

At the Annual General Meeting of the West India Committee, held in London in June, the Chairman (Mr. E. A. DE PASS) remarked that the sugar industry in the Caribbean was, as ever, the most outstanding one demanding Governmental intervention. Working as his Committee did in close collaboration with the Sugar Federation of the British Empire it had become so apparent that in the existing catastrophic conditions the West Indies, with no protected home market, was the most imminently threatened, that the Committee took steps last Spring to place before the late Conservative Government the precarious position of the industry and appealed for an increase in the preference. Mr. AMERY, the then Colonial Secretary, promised his most sympathetic consideration of their suggestions and was prepared to let them state their case to a sub-committee of the Cabinet. This was the position of affairs just prior to the general election, but with the change of Government the outcome of the representations is naturally less certain. At the same time Mr. DE PASS is hopeful that the new Government will not be indifferent to the claims of the producers of the British Caribbean.

The Cuban Sugar Position.

The last few weeks there has been an appreciable if not altogether maintained improvement in the sugar market. In part it has been due to a not unnatural reaction against the era of low prices that have prevailed of recent months, and to that extent must, we suppose, be discounted ; in part to large purchases of Cuban sugar chiefly for England, said to amount to some 250,000 tons ; but largely also to persistent rumours of what Cuba now intends to do in the matter of crop control ; and while nothing definite has been elicited, it seems highly probable that Cuba is bent on retracing her steps and having some form of restriction once more. Cable advices latterly to hand from Havana imply that the President has expressed his intention of renewing measures of restriction and also of creating a single selling agency for the whole of Cuba's output.

The form of restriction adopted may not take the same line that was followed last year and before. It seems more logical ro restrict if at all at the starting point and limit plantings. The unfairness of the last restrictive measures was that they had allowed the cane farmers and the planters to grow unlimited amounts of cane without any indication at the time of planting as to whether or no the whole of that cane was to be allowed to go to the mills. No wonder, then, the planting fraternity were dissatisfied and were foremost in petitioning the President to lift the restrictions last year. Whether artificial restriction of planting is decided on or not, there is some natural

restriction in existence due in part to the unremunerative nature of the crop and accentuated by a long spell of dry weather, so next season's crop may show an appreciable reduction on the present one quite irrespective of whether some form or other of artificial restriction is also applied. In any event, it is too late to restrict plantings for the 1929-30 season, so if the President is bent on restrictive measures for that crop, they must relate if not to the quantity of sugar turned out, at all events to that exported.

The proposal to have a single selling agency would only bring Cuba into line with Java, which latter country, as we know, disposes of over 90 per cent. of its crop through a single agency acting for all the producers, and the all round benefit of this method of sale has long been self-evident. So far Cuba has confined the operations of a selling agency to the disposal of the non-American quota ; but it would appear that now it is intended to include the latter in the operations, a decision which if carried out would undoubtedly strengthen the market for Cuba.

Restriction by Agreement.

It becomes increasingly evident that the only satisfactory way to restrict world production is by private agreement between the principal countries producing sugar for a free market ; for all practical purposes this means Cuba and Java who can, if they elect, call the tune. On another page we reproduce the opinions of Messrs. F. O. Licht, the European beet experts, prepared for the League of Nations Enquiry on Sugar. They come to this same conclusion that such an agreement if honestly worked might well secure some temporary measure of success ; but, taking the longer view, they doubt whether any such policy with all its inherent difficulties would provide a lasting remedy. The true solution in their view lies rather on the consumer's side. An International Committee for encouraging the consumption of sugar if representative of all sugar interests might well work wonders in the way of propagating the uses of sugar, especially in those countries which at present have only a small *per capita* consumption. Here lies a new field of development for the sugar industry, and one that we hope the League of Nations will see its way to press for adoption. It is not of course a measure that the League can enforce ; but the League's influence would not be without its effect in getting the experiment started. What this Propaganda Committee might do is sufficiently if briefly set forth in Messrs. F. O. Licht's argument, to be found elsewhere in this issue.

How to dispose of the present excess with as little inconvenience to all concerned is a knotty problem. Leaving aside the drastic suggestion to destroy it, there is the proposal to denature the sugar and use it in distilling ; another suggestion is that it be used as free samples for new markets, e.g. in China, an expedient that in the long run might more than justify the outlay involved. In any event propaganda to increase consumption should not exclude the question of experimenting with free samples. Whatever be the outcome of this discussion as to ways and means, it is sincerely to be hoped that for the benefit of the world sugar industry at large early steps will be taken to inaugurate concerted action. Will the League of Nations point the way, or must it be left to the Tarifas of the industry to broach conferences ? One such conference has just been held in Brussels between representatives of certain European beet sugar industries, at which it is reported two Cuban representatives have been present. We hope to hear that it has not been without result.

Some Economics of the Present Sugar Position.

The Standard Bank of South Africa *Monthly Review* in a survey of the world sugar situation remarks that it is difficult at first sight to understand why in view of the low prices that have ruled during the past four years the output of sugar has continued steadily to increase. "The answer must be looked for mainly in two directions. In the first place, the capital cost of establishing a plantation and providing it with the necessary transportation and sugar milling installation is very high and it may well pay better to continue to produce sugar to sell at a fraction over prime cost rather than to close down and sacrifice the capital invested; in the second case, as is well known, many countries employ artificial measures to save the local sugar industry from going under. These measures may take the form of Government subsidies open or disguised, but more usually consist of the cartellization of the industry behind a tariff wall. At the very low level of prices now ruling, however, the position becomes difficult for even such protected and cartellized industries; for when the export price falls below prime production costs, exporting can only take place by the definite sacrifice of a portion of the profit made on local sales, while if the world price falls far enough it becomes possible to import sugar over the tariff barrier."

This is probably the basic factor which has induced the protected European industries to support actively the recent conferences at Geneva. But it must not be overlooked that the main obstacle to the endeavours of private enterprise to co-ordinate production to consumption is the fact that Java, the second largest producer, holds aloof for the time being, for the sufficient reason that even with low prices as they are she can apparently make more than a "fraction over prime cost."

The Java Crop Outlook.

According to Messrs. CZARNIKOW, it is learnt that while the climatic conditions in Java are not altogether unfavourable to the crop, the ideal weather experienced last year has not been repeated, and having regard to the smaller yields being obtained this season, it is not improbable that the current production may be no larger than that of 1928. Apart from weather conditions, the lower yield of sugar in the canes this season appears to be due to premature arrowing, a fault to which POJ canes are apparently not immune. Apropos of Java canes, LICHT reports that at the Soerabaia Congress held in June, D. KONINGSBERGER, Manager of the Java Sugar Experiment Station in Pasoeroean, pointed out that the triumphal march of the POJ 2878 would soon have reached its culmination point. New cane varieties similar to the POJ 2878, but more suitable for the conditions of the soil as well as for the climate, would probably break the predominance of 2878. The perfection of the cane sugar culture had not yet been reached. By special cane varieties production might yet further be increased.

Home Beet Sugar Results.

The results of the beet sugar campaigns for 1928-29 in the United Kingdom factories have been published rather later than usual this year. Details will be found on another page. They all illustrate the fact that thanks to the unpropitious weather experienced in 1927, the acreage offered by the farmers in 1928 fell considerably. But the latter season was a more favourable one from an agricultural point of view and as a consequence a higher sugar content was everywhere achieved which went a considerable way to neutralizing the effects of the smaller area cropped. The Anglo-Dutch group, all things con-

sidered, had a satisfactory year at their factories at Ely, Ipswich, Kings Lynn, and Cantley (though Ely was the only one to report an improvement in trading profits), and the previous dividends have nearly all been maintained, while reserves have been added to albeit on a smaller scale. This was the first year of the reduced subsidy, and it is interesting to note that the farmers' share in the fall, viz., 8s., was, thanks to an increased return per acre and a higher sugar content, reduced to sums varying between 2s. 4d. and 4s. the ton instead of a full 8s.

The Anglo-Scottish group have been less fortunate. Even Kidderminster which is able to pay a dividend of 10 per cent. free of tax, had its trading profit reduced by more than 50 per cent., while the factories at York, Cupar, and Felstead have only been able between them to earn £37,766, a sum slightly less than the debenture interest charges. At the same time a considerable slice of the debenture debt has been repaid. The cause of this setback is attributed by the Chairman (LORD WEIR), at the annual meetings, to the very poor support accorded by the growers, mainly due to the lack of confidence shown by them after a bad agricultural season in 1927. Confidence is fortunately now returning, and this season's sowings are reported to show an increase of some 35 per cent.

LORD WEIR took the opportunity at these meetings to refer to the embarkation of his factories in the experiment of refining foreign sugars in the off-season. This was first tried at Cupar and was so successful in staving off what must inevitably otherwise have been a shut-down, that York, Kidderminster and Colwick were likewise adapted for off-season refining. One factor in the case was the point that these factories were so situated geographically in relation to the consuming population that they could distribute with a substantial saving on transport charges as compared with bringing sugar from the big refining houses in London and Liverpool. Unfortunately the latter concerns have not taken kindly to the new competitors for this trade, and a price war has been in evidence in the course of which the margin between raw and refined has been cut, as LORD WEIR remarked, to a figure less than that being obtained when Government help for the refiners was demanded some 18 months ago.

Another Refinery Merger.

While on the subject of refining, it is necessary to record the recent acquisition by Messrs. TATE & LYLE LTD. of the refining business of Messrs. FAIRRIE & Co. LTD. of Liverpool. By this step the premier British refining firm secures control of practically all the refining trade in the United Kingdom, apart from that undertaken by the beet sugar factories. The firm of FAIRRIE & Co. will remain as a separate concern under the general management of Mr. GEOFFREY FAIRRIE. This old Liverpool firm was formed in 1867 with a capital of £120,000, largely held by the FAIRRIE and MACFIE families; it at present finds employment for about 900 people. It is stated that the terms were decidedly favourable, in that there was competition from a Dutch refining firm who were endeavouring to secure a footing in the British refining industry. It may be assumed that Messrs. TATE & LYLE's completion of the transaction was actuated by a natural desire not to allow any foreign firm to get a foothold in an existing refinery in this country.

CUBAN 1928-29 CROP FIGURES.—Messrs. Guma & Mejer have given their final figures of the Cuban 1928-29 sugar crop as 5,156,315 long tons, which compares with their estimate of 5,218,428 tons. The number of factories at work was 163, and the largest single output was that of Central Preston with 1,014,425 sacks (147,182 tons).

League of Nations Enquiry on Sugar.

The Beet Sugar Industry and its Prospects.

Among the memoranda prepared for the Economic Committee of the League of Nations dealing with the sugar question, besides that on cane sugar submitted by Dr. H. C. PRINSEN GEERLIGS (the gist of which was given in our June issue) there was one by Messrs. F. O. LICHT of Magdeburg, on the World Production of Beet Sugar and its Prospects. In what follows we summarize their principal points and quote here and there from their statement.[1]

The Authors emphasized at the outset how enormously the conditions of beet sugar production may vary, not only in different countries, but even in different parts of the same country, given only the influence of the usual factors. These, apart from technical marketing factors and prices, include agricultural factors such as climate, soil, the general level of agriculture and methods of cultivation, seed and fertilizers, etc., as well as the more technical factors of the manufacturing side, such as size and equipment of factories, the more or less scientific methods of working, the utilization of by-products, etc. But exceptional influences, of which the Great War was the biggest example, have caused a decisive revolution in the conditions of production and accentuated the competition with cane sugar.

At the commencement of the century the supremacy of beet sugar in the world market was unchallenged, but since then it has gradually declined, the consequences of the Brussels Convention enacted in 1903 proving very unfavourable for beet sugar, while simultaneously the improvement and cheapening of cane sugar production in overseas countries owing to better methods of seed selection and cultivation, the rationalization of manufacture and improvements in selling methods, have gone far to reverse the supremacy and give a decided ascendancy to cane. But it was the coming of the war which effected the complete revolution in the world sugar industry. Thereby beet sugar production dropped, till in 1919-20 it amounted to little over $2\frac{1}{2}$ million tons, while Cuba started on her career of big cane sugar crops. The European area under beet which had amounted roughly to 2,200,000 hectares in 1913-14 reached its lowest figure in 1920-21, with only 1,279,346 hectares. The production of raw sugar fell from 8,179,013 tons in 1913-14 to 2,589,923 tons in 1919-20. This great fall in production is primarily due, of course, to the smaller area under the crop, but also in some degree to the smaller yield per hectare in all the belligerent countries ; this was the natural outcome of unsatisfactory cultivation, insufficient manure, etc., and it has not yet been fully remedied in many countries. The extent to which the different countries have been affected by these changes varies of course considerably, according as to whether they did or did not take part directly in the war. Nevertheless in the later post-war period a slow and steady recovery in European beet growing has been achieved ; but only now is the production of 1913-14 being approximately attained.

Costs of Production.—Messrs. LICHT affirm that " the cost of production of beet sugar is extremely difficult to determine. The mere division into the three stages of production—beets, raw sugar and refined sugar—presents difficulty on account of the difference in conditions. The difficulty is far greater if we attempt to estimate the original cost for the areas under cultivation, first by the unit of weight in individual undertakings and then on the average for a whole country. We must reckon, besides, with the fact that,

[1] Taken from " Sugar : Memoranda prepared for the Economic Committee by Dr. H. C. PRINSEN GEERLIGS, Messrs. F. O. LICHT, and Dr. GUSTAV MIKUSCH." League of Nations Publications, II, Economic and Financial, 1929. II, 20. (Constable & Co Ltd., 10, Orange Street, London, W.C. 2(.

even in countries which lead the way in industry and statistics, really reliable figures are obtainable only to a limited extent. Where these are forthcoming they almost invariably relate only to parts of the country in question, e.g., the area of a particular industrial group, etc. The data available to the public from trade periodicals and the daily Press, or from economic memorials, preambles to laws, etc., are generally very incomplete. In many cases the representatives of the industry profess to be unable, for reasons of internal policy or on other grounds, to make any disclosures as to their costs of production, which they regard as a trade secret."

In the short time available for dealing with the question Messrs. LICHT, although they were able to obtain valuable material from a few quarters, were not able to make sufficiently extensive investigations to justify them in giving any comparative figures regarding the cost prices of European sugar production and they therefore refrain from offering any. But they remark that the scanty material they possess " is sufficient to prove that the cost of production of European beet sugar, both for the agricultural and the manufacturing side of the industry, is much higher than in the pre-war period. In Germany, for instance, with her enormously increased taxes, shorter working hours, social burdens, and the reparation debt which weighs so heavily on the whole economic structure, this rise must be estimated on the average at 170 per cent. for the agricultural and 150 per cent. for the manufacturing side."

Future Prospects of Beet Sugar Production.—Even before the war European beet sugar production was admittedly hard pressed and the further advance of cane sugar could only have been checked, if at all, by exceptional measures. At the same time there can be no doubt that the sensational advance of cane sugar would have been a far slower process but for the economic changes caused by the war, which eliminated the production of the Central European beet countries from the market for some years.

The advantage possessed by cane production over that of beet is however illustrated by the following figures, which give the respective productions per land unit :—

	Yield per hectare in metric quintals	Yield per cent.	Yield of raw sugar per hectare in metric quintals
Cane	1000	10	100
Beet	300	16	48

" On a rough average, therefore, about 100 per cent. more cane than beet sugar is produced per hectare. Moreover—and this is a material factor in beet-growing, which calls for more intensive labour than any other crop—wages are now much higher in Europe. We may cite further the high cost of land and the heavy taxes, duties, social burdens, etc., which fall with greater or less weight on producers in all European countries ; in Germany, agriculture and the sugar industry, like all other industries, have to bear an additional heavy burden in the shape of reparation charges. Almost all these adverse factors, which had already begun to tell on beet sugar production before the war, have been intensified by war and post-war conditions, so that to-day it is unlikely that any beet sugar-producing country could compete with cane sugar on the free world market. For this reason, almost all European countries have sought to protect their home markets from foreign sugar by means of higher tariffs; England has also followed a similar course and has created a native beet sugar industry by granting subsidies on a large scale. The European countries take this line for reasons financial, technical and socio-economic.

"The reason why all Governments cling so stubbornly to beet culture is not to be found mainly in considerations of financial policy, but in agricultural and social considerations. Beet culture in itself, without reference to sugar production, is for many reasons a vital condition of all intensive agriculture. From the strictly agricultural point of view, it is universally recognised that beet-growing insures a good rotation of crops, clean fields, a richer yield of other crops following on beet, and a general improvement of the soil. Not less important are the many uses of the residual by-products of the beet, such as slices or pulp, leaves and molasses, which enable the farmer to keep larger stocks of cattle and so increase the production of meat, milk, butter and cheese. Molasses are also increasingly used in many chemical processes. Sugar beet culture, inclusive of leaves, slices and tops, yields on the average a far higher proportion per hectare of starch equivalent and proteins (76·70 and 3·51 metric quintals respectively) than any other crop.

"The labour problem in relation to the sugar industry must also be examined. Beet growing, as a highly intensive form of cultivation, provides employment for a considerable portion of the rural population, whose numbers would be greatly reduced if this crop were discontinued; the sugar factories enable many field labourers to earn good wages during the winter months when they would otherwise be unemployed. In terms of men's working years, the number of hands employed in intensive farming on good soil, without beet crops, is 3 per 25 hectares; in the same conditions, with 10 per cent. beet crops it is 5 per 25 hectares, with 20 per cent. beet crops 6 per 25 hectares and with 30 per cent. beet crops about 7·5 per 25 hectares.

"These reasons explain why the vast majority of European countries protect their sugar industry even at the cost of burdening the consumer with prices considerably in excess of those ruling on the world market. This state of things is bound to continue in the future, and even Governments which base their policies purely on the consumer's interests will certainly be swayed by the above considerations.

"A special problem arises in countries whose production exceeds their own requirements and which accordingly are obliged to try to place a percentage of their output on the free international market. Here they have to compete with cane sugar, the cost of production of which, as we have already seen, is materially below that of beet sugar. The latter therefore can only hold its own if it is granted special treatment by the importing countries or if the producing country is particularly well situated in relation to its markets. Otherwise, the sugar exports must be assisted at the expense of the home consumer; in other words, the higher price charged for sugar for home consumption, and bounties in various shapes and forms, must cheapen the exported sugar sufficiently to enable it to compete in the world market. There are, however, limits to this selling policy (dumping). They are fixed by the poor financial position—recognized on all sides—of the sugar industry and by the economic depression everywhere prevailing in post-war Europe."

After setting down the above more or less theoretical reflections, Messrs. LICHT proceeded to discuss seriatim the prospects of the different European beet sugar producing countries. Their final conclusion is that in the existing state of things the possibilities of development for European beet sugar production can be set down as only limited. Beet sugar is not in a position, without special measures, to compete with cane in the open market. "On the one hand, a decline in production seems probable in all countries whose output exceeds their home requirements, unless exportation is fostered by quite exceptional circumstances. On the other hand, in a number of countries

a rise in home consumption—and hence in sugar production—may be regarded as possible. European sugar production as a whole should remain during the next few years at about the same level as at present ; a slight increase is, however, by no means impossible."

The Remedy for World Sugar Depression.—Dealing with the question of remedies for the present world sugar crisis, Messrs. LICHT refer to Cuba's policy of restriction now abandoned and remark that " this expedient might well secure some temporary measure of success ; but all the principal exporting countries that compete on the international market would have to work together and strive honestly and wholeheartedly to solve the problem. Their task will be materially lightened by the fact that the number of these countries is relatively small. One drawback, however, is of course the great diversity of interests and the heavy sacrifices involved. But all such artificial ways of regulating production and export can never provide a lasting remedy, because they run counter to the natural course of economic development. All experience goes to show that, owing to the many-sidedness of economic life, any such action releases natural forces which operate in the opposite direction and defeat the artificial economic measures. For the same reason, we do not anticipate any relief from the conclusion of an agreement on the lines of the Brussels Convention.

" On the other hand, there seems no reason why an attempt should not be made to solve the problem from the consumer's side. The chief merit of this method is that a rise in consumption will obviously be to the immense advantage of the sugar industry in all countries. Here, then, is a universally accepted, indisputable and well-founded basis of negotiation ready to hand. Without entering into details, we suggest, by way of such a solution, the appointment of an International Committee for encouraging the consumption of sugar, whose function would be to increase consumption by propaganda of every kind, to discover new scientific applications for sugar by means of prize competitions and other measures, etc. That such a movement, if properly exploited, may achieve success is proved by the results of advertisement and propaganda, within the national frontiers, that have been obtained by the German and other European sugar industries. The International Committee would, of course, devote its attention primarily to countries with a relatively small per capita consumption. Great possibilities of success lie in this direction, if political conditions in these countries become more stable and the buying-power of the population greater. Even if the costs were considerable, they might be covered easily enough by levying a very small percentage on production.

" These private efforts would be enormously assisted if Governments would simultaneously decide to reduce the sugar taxes, which in some countries are unduly high. The resulting fall in home prices would necessarily be followed by a rise in home consumption. Concurrently, of course, agriculture and the beet industry in every country must continue their efforts to bring down the cost of production by intensive cultivation and scientific management."

FIRST JAVA CROP ESTIMATE.—As we go to press we learn that the first official estimate of the Java sugar crop is given as : Associated Mills, 2,728,000 metric tons ; Non-associated Mills, 272,000 ; total, 3,000,000 metric tons, or 2,953,000 long tons. On the Head Sugar basis this is equivalent to 2,970,000 metric or 2,923,000 long tons.

Sugar in British India.

A Survey of the Present Position.

In the May number of *Empire Production & Export* was published a special report prepared by Mr. Noël Deerr for the Sugar Federation of the British Empire, surveying the position of the sugar industry in British India.[1] We give below some extracts dealing with the more technical side of the industry and the problems to be faced in the near future.

Cultivation Problems.—Dealing with conditions of cultivation, Mr. Deerr points out that the introduction of modern methods into India has to meet the existence of certain agricultural practices which are antagonistic to economic operation. A factory to be an economic success must operate yearly over a certain period, which may be fixed at 120 working days. But in the ryot's view the cane season should be one of short duration, lasting a month or six weeks. Time taken in maturing the cane after the vegetative period has ceased is regarded by him as unproductive. "That metabolic processes are going on in the cane after growth has ceased making the material more valuable to the miller is of no interest to him. These metabolic processes do not affect the yield of gur, which does not demand the separation of the crystals of sugar." All that interests him is to get his land cleared and prepare it for the next crop.

Factory Development.—The modern Indian sugar industry, as distinct from the refining of gur, dates from 1900 ; but it has been chiefly since the war, and under the impetus of an inflated rupee and exaggerated prices, that factory expansion has been most active. In all there are now in operation 26 factories, of which 21 are in Behar and the United Provinces, three in Madras, and one each in Bombay and Burma. "The combined capacity of these factories, over a working season of 120 days, may be put at 900,000 tons of cane, which, if treated with the best skill and equipment, should produce, year in and year out, 9·75 per cent. on cane of direct consumption white sugar. Actually, the cane to be milled for the season 1928-29 may be estimated at 800,000 tons, which, at an average yield of 8·25 per cent., will afford 66,000 tons of sugar. The average quantity of cane dealt with seasonally in each of these mills will be rather under 30,000 tons, whence will be obtained about 2000 to 2500 tons of sugar. The largest quantity dealt with by any factory in a season is just over 60,000 tons, whence was produced 6000 tons of sugar, the yield being 9·85 per cent. The highest seasonal yield yet obtained in the Behar-United Provinces group is 10·43 per cent., but this has been exceeded by the Belapur factory in Bombay, and by the Shawmat factory, in Burma, working on a short crop of fully matured cane.

The equipment of these factories, as they stand to-day, is generally of reasonable efficiency. There are in operation two 17-roller mills, one 16-roller, eight 14-roller, one 12-roller and at least ten 11-roller mills. Six of the factories operate the carbonatation process. In economy with regard to steam utilization the factories are deficient, as all, except two, operate with an isolated triple effect. Pan power is generally sufficient, while with regard to white sugar manufacture, the centrifugals are generally below capacity.

Some early errors.—"The progress of the manufacturing side of the industry is worthy of examination, and contains some points of interest. In its early days the present industry suffered from a lack of appreciation of the problems involved. Indian cane was recognized as affording a poor crop in the field, and, following on a singular confusion of ideas, it became accepted

[1] *Empire Production and Export*, No. 153, pp. 101-108.

that this cane would also give poor results on milling. Consequently, a policy of poorly-equipped factories, operating with manufacturing costs reduced to a minimum, was adopted. Dividends were looked for from this policy, combined with cheap raw material and cheap, but inefficient, labour. Actually, both premises and conclusion were in error. The raw material, while inferior to the cane of higher sugar content grown in more favoured areas, is yet of fair quality from the miller's viewpoint. If it had been of such inferior quality as was supposed, the policy to have adopted should have been the installation of the most efficient machinery operated under the most competent technical control, so as to compensate for the supposed deficiency in the quality of the raw material.

"The actual milling value of Northern India cane can be estimated from detailed observations which have been made over the past seven years, covering the operations of six factories, and representative of 1,000,000 tons of cane. These have given an average sugar content of 11·85 per cent., with extremes for any year of 11·56 per cent. and 12·20 per cent. For individual factories, the eclectic extremes are 10·18 per cent. and 13 per cent.

"The recognition that the factories were being operated on a false basis was made some six years ago by the pioneer firm of Messrs. Begg, Sutherland & Co., and to them is due the credit of arresting a serious economic waste. Their example is now being followed in greater or less degree by the other commercial houses engaged in sugar production. While 20 years ago a yield of 7 per cent. was considered satisfactory, the average yield in factories operated by this firm has been raised over the past two years to an average of 9·5 per cent., with a maximum of 10·43 per cent. in the case of an individual factory. To illustrate the great progress that has been made by this firm, the yield over a series of years is given :—Five years ending 1911, 6·32 per cent.; five years ending 1916, 7·18 per cent.; five years ending 1921, 7·29 per cent.; five years ending 1926, 8·16 per cent.; and two years ending 1928, 9·50 per cent. This result has only been obtained by the expenditure of much capital and by facing the difficulties peculiar to India."

The Gur Industry.—"The problems associated with the gur industry are the most important in the internal economy of the Peninsula. The village industry remains untouched. Here the cane is crushed in bullock mills and the juice concentrated to a mass containing about 90 per cent. of solid matter, and in this state it appears in the market without any separation of the crystals of sugar. Even in this primitive industry there are grades of efficiency passing from the pestle and mortar mill (which often utilizes the hollow stump of a tree as the mortar), through bullock and operated wooden and iron roller mills to plants operated by a small oil engine. In some of these crystal sugar is produced through the agency of hand-operated centrifugals. In nothing but size do these differ from "Common Process" factories as opposed to "Vacuum Pan" factories, many of the first of which existed in the West Indies thirty years ago."

The enormous waste that occurs in this system is self-evident. Mr. Deerr makes an effort to calculate the economic loss occasioned by utilizing 29,000,000 tons of cane for gur manufacture instead of treating it in efficient factories. He puts the value of the gur as a marketable raw material for the refiner at £4 per ton. On that basis the value of 2,900,000 tons of gur is reckoned at £11,600,000, or nearly 25 millions sterling less than the corresponding amount of white sugar might fetch. In addition to the manufacturing loss, there is a loss equally great due to deficiency in agricultural processes.

The average return of cane per acre in India is still only about 10 tons, whereas 20 tons can and should be obtained. On this basis the three million acres should be capable of producing six million tons of sugar worth with the accompanying molasses £72,724,000. The combined agricultural and manufacturing loss then appears as about sixty millions sterling.

A suggested gur and sugar system.—It may be argued that the Indian consumer prefers gur to white sugar and so must have it manufactured. Mr. DEERR however points out that the cane now produced, if properly handled, would provide not only the present demands for gur but also the 800,000 or so tons of white sugar at present imported from abroad. The basis of his argument is as follows.

A single 3-roller bullock mill, by means of which the great proportion of the cane in India is crushed, will not extract more than 75 per cent. of the juice in the cane as compared with the 95 per cent. obtained in efficient multiple milling trains if the latter were in use. The 2,900,000 tons of gur estimated to be the requirements of India would then be obtained from 21,750,000 tons of cane so milled, as compared with the 29,000,000 tons at present required. This would set free, for use in the manufacture of white sugar, 8,250,000 tons of cane, which, at less than 10 per cent. yield, would supply the 800,000 tons of white sugar now imported. Such a scheme would demand the centralization of the manufacture of gur in large scale factories.

Given fixed proportions of gur and sugar the design and lay out of such a plant would offer no difficulty. Preliminary estimates indicate that, for such a plant, quadrupling the cane capacity and converting one quarter the output into sugar and three-quarters into gur, the cost of the plant would be no more than doubled. At the present prices of cane and gur the production of the latter, even in a factory of large capacity and of the highest milling efficiency, would not be so profitable as the production of sugar, but even a small margin of profit on the gur output would still allow the process to be economic. Another point to be considered in a scheme of this nature is the possibility of the economic utilization of the surplus bagasse which would accumulate in large quantities.

Costs of production.—Mr. DEERR goes on to discuss the cost of sugar production in India. To show what can be done he quotes eclectic figures, representative of the highest efficiency that has yet been recorded in India, but such as he considers are capable of reproduction under competitive conditions. From these he arrives at the conclusion that the cost of production of white sugar from cane yielding 10 per cent. would be £12·95 per ton. For gur the combined agricultural and manufacturing costs should average £10·12 per ton.

The position to-day.—The yield and efficiency of the Indian sugar factories has made great strides of late years. "The fall in prices (writes Mr. DEERR in conclusion) which occurred after the excessive rise in 1920 has been met by organization, by the adoption of improved machinery and methods, and by increase in yield in both field and factory. That the production of sugar is a process that has to be controlled by the application of technical skill is now thoroughly recognized, and it is a matter of encouragement that considerable development has taken place since the fall in prices occurred. On the agricultural side the work of BARBER and his colleagues supported by the Provincial Departments of Agriculture, by the Imperial Station at Pusa, and by the more enterprising firms is bearing fruit. There is no one more conservative and hard to move than the ryot, but now that he has recognized the merit

of the work done on his behalf in the breeding of canes selected for his conditions, extension is proceeding apace. The increased yield from these canes cannot but have the effect of reducing the cost of production, and at the same time of making the industry more attractive."

At the same time the most essential matter of all is the condition of agriculture in India. Tariffs and efficiency in manufacture cannot solve the problem while the return of cane per acre remains at only 10 tons. In nearly all the essentials for the large production of cane Indian agriculture is at fault. One variety of cane infected endemically with disease organisms persists from year to year ; implemental cultivation remains of the most primitive character ; maintenance of fertility is lacking, due to cow dung being used as fuel and to an almost complete neglect of the return of plant residues to the soil ; farming, as understood in western lands, barely exists. Only irrigation compares favourably ; but even here the return from it falls far below that achieved elsewhere, doubtless due to the absence of the other essential factors.

Cane Disease and its Effect on the Java Ratio.

By HILARION G. HENARES and CATALINO G. AURELIO.

The steady drop of the recovery in piculs per ton cane after a few weeks of milling in Isabela Sugar Company, Inc., Sugar Central in the Philippine Islands, has led the writers to investigate the cause or causes of this drop which means so much to planters and to Central alike.

There were a few factors which appeared very valuable in this investigation, such as the juice purity, the normal juice factor and the Java ratio. This last, after due consideration, was made the principal point of attack.

The Java Ratio.

In control work the Java ratio $\dfrac{\text{Sucrose per cent. Cane}}{\text{Pol. per cent. First Expressed Juice}}$ should play an important part in the calculation of the theoretical yield in piculs per ton since it is the factor which, when multiplied by the per cent. polarization of each planter's first expressed juice, gives the per cent. sucrose in his cane. The per cent. sucrose in cane multiplied by the mill extraction gives the per cent. sucrose in cane that goes to the boiling house. And this per cent. sucrose per ton cane going to the boiling house multiplied by the S.J.M. formula gives the per cent. theoretical recovery from every ton cane per degree polarization of the crusher juice. Taking the gravity purity of molasses as variable. according to the recommendation of Mr. WALKER, the formula, $\dfrac{S \times (J\text{-}M)}{J \times (S\text{-}M)} \times$ Java ratio $\times$ Extraction, gives the basis of WALKER's table, which is used in several Bank Centrals for figuring the theoretical yields.

To some, " the value of such a factor as the Java ratio is in inverse proportion to its variability, that is, the more nearly constant it is, the greater its utility " ; but the present writers have realized that its value is constant through its variability, because its variability shows to a great extent the condition and quality of the cane that passes through the mill.

Object of the Present Work.

The object of the present work therefore was to ascertain some of the causes of the variation of the Java ratio, and to this end a series of experiments were run in order to determine the difference in the Java ratios of healthy and diseased canes.

Diseased Cane.—By "diseased cane" we mean cane which has been attacked by insect pests and micro-organisms. These diseases are more fully described by Mr. H. ATHERTON LEE in a letter to Judge RAFAEL CORPUS, Manager of the Philippine Sugar Centrals Agency, on January 23rd, 1929, a great part of which is quoted as an appendix to this paper. The healthy canes we have used in these experiments were those apparently without any visible marks of disease, whether caused by insects or micro-organisms.

PROCEDURE.

Samples were taken from the cars in the yard; 10 samples of diseased and 10 of healthy canes were taken for each of the varieties under study; Luzon White, Negros Purple and Badilla. Each was stripped off with trash and mud, passed three times through the laboratory hand mill, and the bagasse and juice collected carefully in well dried containers. Passing three times through the hand mill gives approximately the same juice extraction as the crusher. Bagasse and juice were immediately weighed and analysed according to the standard method of analysis of the Association of Hawaiian Technologists. This mill was washed and dried after each sample was run through.

The juice and bagasse were weighed independently; and although the sum of the weights of juice and bagasse did not exactly equal the weight of the original cane, due to evaporation and the little unavoidable dripping during grinding, yet, since all the samples were treated in the same way, the result was relatively the same. The large number of analytical results which were obtained were collected and examined, but for the sake of brevity these are not presented here.[1]

DISCUSSION OF RESULTS.

The drop of Java ratio from 83·31 during the past milling season led us to question probable causes. At first we thought that the hydraulic weight on the crusher was not enough, but after this was increased the Java ratio was not improved. All scales were checked and re-checked as well as laboratory analyses and yet the Java ratio went down lower than when we started. The results of the experiment pointed to the real cause of the drop. The Table shows the relative Java ratios of the healthy and diseased canes.

CONCLUSION.

Practically all the sucrose in the canes must be contained in the outer ring of the stalk. When such cane passes through the crusher, almost all the juice of the outside ring is expressed. The crusher juice, therefore, gives a good analysis with relatively high per cent. polarization and purity. But since the centre of the cane hardly contains any sucrose, due to the effect of the disease, when the total juice expressed has been weighed and the sucrose content of the juice calculated on the basis of weight of cane, the percentage of sucrose is low. Hence a low Java ratio is the result.

TABLE.

CANE.	Java Ratio.	Fibre in Cane.	Sucrose in Cane.
Badilla Healthy	82·18	13·68	16·69
Badilla Diseased	64·90	13·84	6·86
Luzon White Healthy	83·42	12·98	13·74
Luzon White Diseased	66·11	17·34	8·37
Negros Purple Healthy	82·23	13·12	16·43
Negros Purple Diseased	71·43	13·60	6·60

1 The laboratory routine was performed by Mr. PEDRO VALENZUELA, a recent graduate in the College of Agriculture, University of the Philippines. All calculations are based on clean cane.

Cane Disease and its Effect on the Java Ratio.

APPENDIX.

"The word disease often conveys an alarming impression, but this disease is nothing new and is no cause for general alarm. It has been present in Negros and the Philippines as a whole, for many years, but due to particularly favourable circumstances this year it seems to be more severe now than in other years.

"The disease is for the most part what we call pineapple disease, from the faint odour of pineapples which is usually found in the diseased cane. It is caused by a fungus which is known to scientific people as *Thielaviopsis paradoxa,* and there are other infections in the cane caused by similar fungi. This *Thielaviopsis paradoxa* and these other fungi are what we call low-grade *pathogens,* that is, they are not highly virulent parasites but are dependent upon favourable conditions for infection. These fungi exist in all our cane fields on the dead cane and in cane trash. They are unable to infect a cane which has a sound rind but depend for infection upon entrance through the rind made by cane borers or by cane broken by some other means.

"The present season has afforded a very favourable chain of circumstances for such fungus infection. In the first place, the *baguio* (typhoon) on November 23rd blew down a very large percentage of the cane and in the case of the Badilla variety broke and cracked a great many stalks. These cracked stalks in themselves were very easily infected by these low-grade fungi. The fallen cane was also much more readily infested by the cane borers, *Rhabdocnemis* species, than would be upright cane free from trash.

"Following this *baguio,* with the cane in a broken condition and with borer injuries much more common than usual to provide means of ingress for fungus spores, there was a period of standing water in many cane fields followed by wet humid weather. This standing water and wet humid weather has been worse at Isabela than in most other districts and such humid conditions are very favourable for these fungi to infect and spread. Thus, there has been a chain of circumstances which has led to what seems to be a very considerable higher percentage of our cane at Isabela being infected with these low grade fungi.

"Isabela conditions this year have been particularly favourable for such fungus development. Following the *baguio,* many cane fields at Isabela were under water for several days, and standing water around the bases of the cane stalks would provide an ideal medium for the spread of fungus spores and subsequent infection. Isabela soils are also more retentive of moisture than the soils of most other Negros districts and, once wet, afford a constant surface for the evaporation of moisture into the air, making the atmospheric conditions humid after the rains.

"Lastly, the situation of Isabela, surrounded on two sides by hills, makes the removal of moisture by air movements considerably slower than in other districts.

"There is also evident a very large formation of aerial roots in the stalks of the cane. The development of aerial roots is favoured by moist humid conditions in Isabela this year. The same chain of circumstances which was favourable for fungus infection also favoured the development of aerial roots. The cane blown down by the *baguio* subsequently became covered with wet cane trash. Then with the continuous wet humid weather which has occurred at Isabela this year, the conditions have been very favourable for the development of aerial roots. This development of aerial roots, of course, would be expected to invert a great deal of sucrose to glucose."

Recent Work in Cane Agriculture.

Studies of Sugar Cane Roots at Different Stages of Growth. **T. S. Venkatraman** and **R. Thomas.** Memoirs of the Agricultural Department in India, Botanical Series, Vol. XVI, No. 5, January, 1929.

The progressive studies of the roots of sugar cane now being carried out at Coimbatore have, on various occasions, been referred to in this Journal; and it is worthy of note that they are being developed on lines not thus far attempted anywhere else. It is perhaps natural that, in a station detached from plantation work and mainly devoted to the raising of cane seedlings, the earlier stages of the roots and their functions and origins have received most attention. Furthermore, being surrounded by a large number of the most various kinds of canes, cultivated and wild, comparative studies of the roots of these everywhere dominate. An entirely separate chapter in the book of the sugar cane root is gradually being written, and one that is fundamental to our knowledge of this little understood part of the plant. From the first, a sharp distinction is drawn between the roots arising from the root zone of the planted set and the subsequent ones from the nodes of the young shoot developed from its buds, "set roots" and "shoot roots" as they are termed respectively; and as will be quickly realized from a study of the work already published, a thorough knowledge of the rôles played by these two classes of roots may have a great deal to do with the rapid and even development of every field of canes, and also with the relative resistance of the varieties planted to drought or waterlogging and unfavourable weather conditions.

The present paper summarizes in brief paragraphs some of the more important results thus far obtained, together with a good deal of new matter; and it appropriately finds its place in the series of Botanical Memoirs of the Indian Agricultural Department, as against the former papers in the Agricultural Journal. The Memoir is beautifully illustrated at every stage and has a number of tables to make the points clear; and it is largely owing to a full use of these devices that the actual text only occupies about ten pages, in spite of the wide field covered by the observations and experiments. Here is a solid piece of work and, although one may not always agree with the interpretations, the speaking pictures and carefully compiled tables will be welcomed by all workers on this subject, as they throw a good deal of light on the morphology and physiology of the root system of the sugar cane.

The paper commences with a study of the set roots, passes on to the shoot roots, and then contrasts the two, concluding with a description of two of the various characteristics of cane roots noted by the authors during the course of the work. The number of set roots protruded during the "germination" of the set is first dealt with. Table I gives the average numbers developed during the first ten days in six tropical canes, nine Indian ones, four most prominent Coimbatore seedlings, five of the later POJ seedlings, and certain wild Saccharums. Averaging the figures given, the tropical canes produced 28 (14 to 56), Indian canes 10 (1·5 to 32), Coimbatore seedlings 11 (3·2 to 21·2), POJ seedlings 24 (19·1 to 21·6). *Saccharum spontaneum* developed an average of 2·3 and *S. arundinaceum* 7·7. Among the Indian canes, the Pansahi group protruded fewest (2), and Uba one of its members 1·6. Co 205 resembled its male parent *Saccharum spontaneum* in an average of 3·2, and it is stated that Kassoer also had very few. This tardy development of the set roots is regarded by the authors as an adaptation to unfavourable weather conditions at the time of planting, with the result that a reserve is kept for later seasonable conditions; and there is no doubt that the capacity for going slow in root development offers a ready explanation of the hardiness of Co 205,

Uba, and others, as contrasted with the rapid development and delicate nature of the set roots of thick canes. And coupled with this tardy protrusion, the length of time during which the set roots function is stated to be greatest in *Saccharum spontaneum*, while Co 205 shares this character with it.

Another experiment showed that in its development the set is very sensitive to salinity in the irrigation water : water with 0·5 per cent. solids, chiefly sodium chloride and carbonate, was compared with sweet water with only 0·1 per cent. The dry weights of the shoots and roots at 20 days were calculated, on five or six plants each, of seven Indian cane varieties ; and the general averages of the figures in the Table are as follows : fresh-water 343 grms. and 103 grms., and saline water 187 grms. and 37 grms., respectively. The sprouting of the bud was not found to be closely correlated with the development of the set roots, as the bud burst sometimes before and sometimes after the roots emerged. None the less, as shown in previous work, if at least one set root is not left attached to the bud, the latter always fails to produce a shoot.

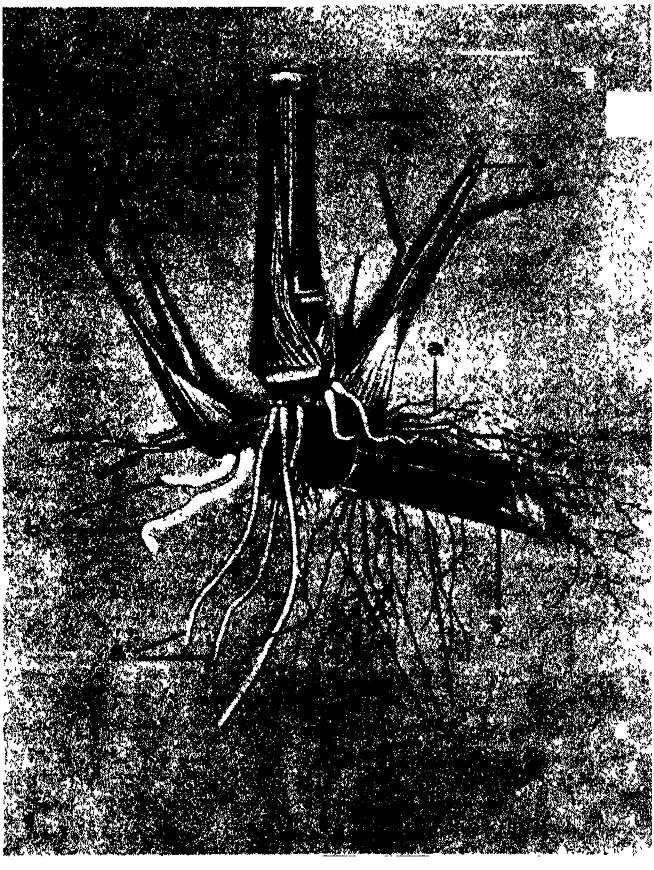
The set roots soon die, and their place is taken by shoot roots. Table III shows the state of affairs at about 40, 60, 80 and 100 days from planting as between the two classes of roots. The dry weights of the roots of five plants each, of three Indian canes and EK 2 average for each plant as follows, during these four periods :—

		Grms.	Grms.	Grms.	Grms
Indian canes :	set roots	0·5	0·36	0·30	0·13
	shoot roots	3·7	9·80	15·60	26·00
EK 2 :	set roots	0·9	0·50	0·50	0·30
	shoot roots	1·2	3·70	17·60	17·30

It is obvious from these figures that the growth of the cane plant is, in the main, dependent on its own (shoot) roots, and therefore it is somewhat surprising to learn how long the plant can be kept alive, on occasion, on the set roots alone. Ten plants of Co 213 were continuously deprived of their shoot roots, while ten others were allowed to develop normally. The mutilated plants suffered markedly in loss of vigour in comparison with the normal ones, and they did not arrow at five months, when the flowering season came round ; the other ten arrowed profusely.

In considering the root system of the adult sugar cane plant, the authors refer to the frontispiece of the Memoir, which represents in a diagrammatic manner a young cane plant with its various types of roots. This is reproduced on next page to show the young shoot roots and their character when compared with the set roots ; of course, in the field, there is nothing but a dense mat of roots, in which the different kinds are inextricably entangled. Great stress is laid in this part of the paper on the fact that, normally, the shoot roots only live for a comparatively short period, and then die (just as the set roots do), to be replaced by fresh series developed in succession from the younger nodes of the growing plant. The authors state that they "realized this aspect of the root activities of the cane plant for the first time when they grew canes in water culture, and the root development thus became clear for continuous observation. This was afterwards fully borne out by periodic dissections in the field." This constant change in the root system, it is suggested, results in the plant being enabled to adapt its roots with greater ease to changing environmental conditions, and puzzling features in the periodic dissections have thus been explained. In illustration, it was observed that the roots were comparatively shallow during the middle of June, when the water table was high ; while in September when it was low the roots were much deeper, in the same set of plants.

Differences in the root arrangements of cane varieties are illustrated on a Plate, where the root systems of Purple Mauritius (a tropical cane), *Saccharum spontaneum*, and Co 281 (one of whose great grandparents is *S. spontaneum*), grown under the same conditions, are drawn to scale. Besides differences in density and direction, it may be noted that, while the roots of the first barely exceed one foot in depth, those of the second extend fully to six feet, and in the cross to four feet. It is suggested that, by these and similar studies, carried on in different soils and in different circumstances, it may ultimately be possible to work out the characteristic root development of each



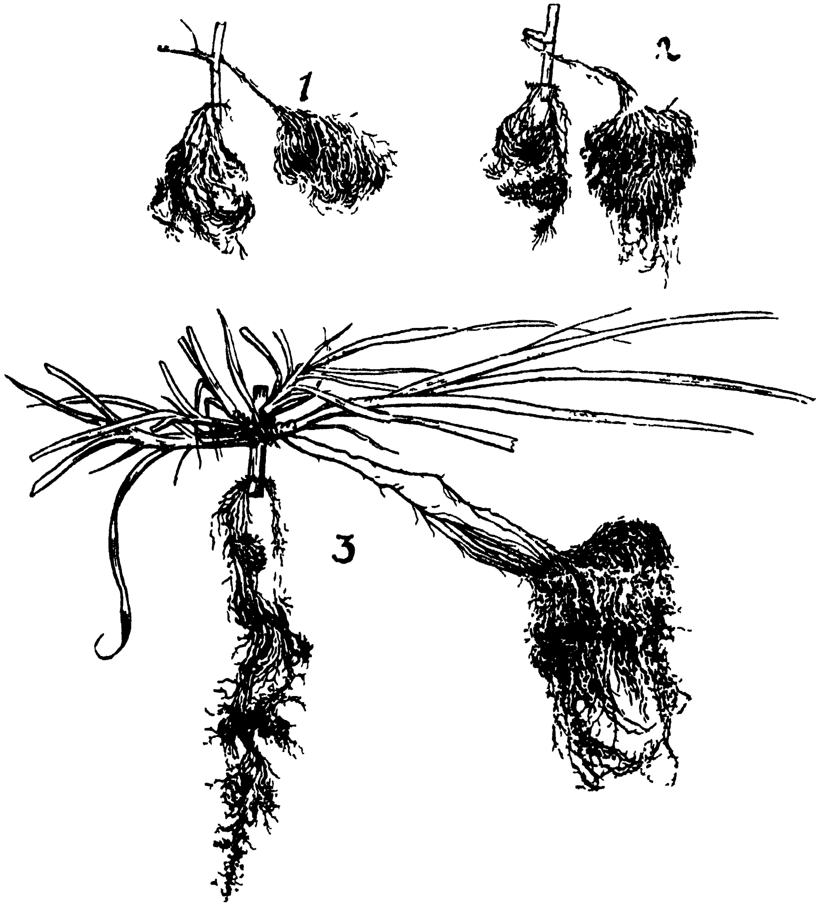
YOUNG CANE PLANT WITH ITS VARIOUS TYPES OF ROOTS.

S. The original planted set.
S¹ Set roots (formed from the set).
a. The first shoot developed from the set.
a¹ Shoot roots developed from a.
b. Other shoots developed from a.
b¹ Shoot roots developed from b.

cane variety of importance, i.e., when and where it develops its series of new roots—knowledge which would be of obvious advantage for appropriate cultural and manurial treatment.

The points of difference between set and shoot roots, discussed in this paper, are relative thickness, powers of soil penetration, density, and vigour of growth. The authors seek to explain these differences, and in certain of

them experimental data are adduced to support the explanations. The two "characteristics of cane roots" already referred to concern a supposed aërotropism and an adaptation for greater rooting efficiency. There is not space to deal with these various matters in the present article; but certain illustrations are reproduced below, to indicate the precision of control attained by the authors in their difficult task of estimating the respective powers of set and shoot roots. In this particular case it was desired to compare the vigour of growth of the two sets of roots. Figs. 1 and 2 represent



the lower portions of two plants of Co 213, grown from two-budded sets placed upright in the soil with only the lower node covered with earth. In due course the circle of set roots on this node developed in the ground, and shoots were allowed to emerge from the upper, free node; but this aerial portion is not shown in the figures. To test the relative growing power of set and shoot roots, the upper nodes were used. One plant (Fig. 1) was induced to form set roots alone from the upper node and six of these were led into the earth (by a method already described in this Journal and devised by THOMAS)[1]; while in the other plant (Fig. 2) shoot roots were encouraged to grow out, and

1 *I.S.J.*, 1928, p. 299.

two of them were also led into the earth. The proportion of roots developed in the latter case was at least as great as in the former, arguing a considerably greater power of growth in the shoot roots than in the set roots under exactly similar conditions. Another experiment with the same idea is shown in Fig. 3. Here another of the same series of plants was grown on all the roots of the basal node for two months, and subsequently the plant was thrown for nutrition on two shoot roots from the upper node for the same period. As seen in the figure, the mass of roots developed from the two shoot roots is considerably greater than that produced by the whole of the circlet of set roots. Over a dozen plants grown in the above manner gave similar results. (It seems to the writer that the first experiment (Figs. 1 and 2) is the more convincing, for, in the second (Fig. 3), account is not taken of the age and size of the plant in the two periods).

One more point is specially worthy of attention, because of the current rough and ready method of estimating the distribution of roots in growing plants by their dry weight in different layers of soil. And this is the authors' study of the relative density of set and shoot roots at the same period of growth of the plant. They find that, at any time, the former have a greater specific gravity than the latter. The two classes of roots were compared, as to density, in three Indian canes and in two tropical, when 60, 80, and 100 days old; with the following results (extracted as averages from the details in Table IV):—

	Grms.	Grms	Grms
Indian : set roots	0·18	0·26	0·29
shoot roots	0·13	0·17	0·18
Tropical : set roots	0·18	0·18	0·27
shoot roots	0·12	0·15	0·17

A KEY FOR THE IDENTIFICATION OF SUGAR CANE DISEASES. **A. F. Bell.** Bulletin No. 2, Division of Pathology. Bureau of Sugar Cane Experiments, Queensland, 1929.

When shortly after the war the British Sugar Research Association was founded, the present writer was asked for suggestions as to profitable lines of work on the plantation side; and among other subjects he laid particular stress on the need for a popular account of the prevailing diseases in the cane field for the use of planters. He accordingly welcomes the appearance of this "Key" which would seem to be admirably suited for the purpose, although primarily intended for Queensland farmers. The author of this Key, in his Introduction, comments on the relative recentness of the study of cane pathology. When it commenced some 40 years ago, most countries had been introducing cane varieties for many years, without the possibility of taking proper precautions against the introduction of diseases at the same time; and consequently, in Queensland at any rate, most of the serious diseases of the cane are present in various parts of the State. The ideal of total exclusion not being possible (and certainly too late now), the first thing of importance is to be able to recognize any disease when it appears in the field and to gauge its relative importance: "hence this Bulletin."

The idea of preparing it was first suggested by AGEE, when the author was on a visit to Hawaii, and it has been steadily held in view during four years' travel through the chief cane growing countries of the world. The subject is treated from the widest point of view, and is quite free from technological details excepting in the last few pages. It is stated to include "any abnormal unhealthy state of the plants irrespective of its origin";

and thus such ailments as growth failure, aluminium toxicity, unfavourable soil solutions, and even base exchange (largely still in the embryonic stage of exact knowledge) are referred to. Some of the "diseases" are of little importance, but it is important for the farmer to know them from more serious ones. The symptoms in the field are the first principle adopted in the classification, but when he comes to such cases as growth failure and so on, where distinctive characters are lacking, the environment is treated in some detail.

Short sections are devoted to the way in which the Key should be used, and the general structure of the cane plant; and then the Key is introduced and covers some seven pages. This is followed by brief descriptions of some 40 odd "diseases," in as many pages, and this portion comprises the body of the bulletin. The text is illustrated by some 28 Plates, and there is a selected bibliography of 60 references—practically all in the English language, and to be found in the head office of the Bureau, for consultation by the farmers.

The main divisions in the Key are based on the part of the plant where the symptoms of the disease appear: cane top, leaf sheath, the exterior of the stem, the interior of the stem, and roots. Taking as an example the cane top section, this is sub-divided as follows: (1) Distortion or malformation: Fiji, downy mildew, tangle top, pokkah boeng, and smut. (2) Comparatively rapid wilting: leaf scald, dry top rot, collar rot, red rot, wilt, root rots and unfavourable soil and soil solution conditions. (3) Pronounced stunting of leaves and absence of stem: Fiji, sereh, gumming, leaf scald. (4) Rotting of cane top; red stripe, eye spot, pokkah boeng, lightning, red rot, etc. Sub-headings assist in running down any particular disease, till perhaps two or three are left together, and the short descriptions appended will usually make determination easy; but after this is accomplished it is recommended that the fuller description in the body of the bulletin should be gone over in detail.

The local leaf symptoms are divided into streaks (8 diseases), spots (6), irregular bands (3) and galls (1). The leaf sheath diseases distinguished are red rot of the leaf sheath, iliau, and red spot of the sheath. Those having symptoms on the exterior of the stem are mosaic, sereh, aluminium toxicity, rind disease and stem gall disease. Those affecting the interior of the stem are separated into: those with general and pronounced discoloration (4), those with restricted discoloration (5), one with exudation from the cut ends, and one also with internal galls. Diseases with symptoms in the roots are divided into three main classes, and being very heterogeneous are given here in more detail.

I.—A general failure of growth, development of less than the normal quantity of roots, followed by a yellowing and wilting of the cane top and a rotting of the roots present:—

(*A*) Non-infectious, caused by unfavourable concentrations of inorganic salts in the soil solution: salt injury, aluminium and ferrous iron toxicity, and growth failure due to unfavourable base ratio.

(*B*) Infectious, caused by some (possibly many) of the soil-inhabiting fungi: root rots of Pythium type, root rots of Marasmius type.

II.—General failure of growth caused by destruction or mutilation of roots by soil fauna, usually followed by the entry of weak parasites and subsequent rotting of the roots.

(*A*) Nematodes (4 forms). (*B*) Macroscopic fauna such as springtails, centipedes, snails, etc.

III.—Stunting and death of the canes by flowering parasites which attack the roots and bear their flowers at the base of the stool. Striga, Aeginetia (*Alectra brasiliensis* might have been added).

The descriptions in the body of the paper are laid down on a uniform plan. Each name is accompanied by one or two references to the bibliography, a list of synonyms, and the name of the causal agent if it is known. Then follow two sections headed, Appearance of the Disease, and General Remarks; and these are followed by a brief statement of the distribution. Leaf scald has been selected as not too long for giving in full, and giving some useful information.

LEAF-SCALD (50).

Alternative name—Java gumming, gomziekte.

Causal agent—*Bacterium* sp.

APPEARANCE OF DISEASE. (PLATES II AND VIII).

Leaf-scald resembles gumming in being primarily a disease of the vascular tissues; the two diseases have many points in common and until recently considerable confusion existed as to their separate identity, or not, but that they are two distinct diseases has been demonstrated by the publications of NORTH, in Australia, and WILBRINK, in Java. Two distinct phases of leaf-scald occur and they have been classed as (*a*) chronic, and (*b*) acute.

Chronic Phase.—The main external symptom from which a diagnosis may be made is the presence of narrow white streaks upon the leaves of the diseased plants. The streaks are quite straight and regular, and follow the course of the vascular bundles, as in the case of gumming, but the streaks are white or only a very pale yellow, and are more sharply defined. Moreover, they are not restricted to the leaf blade but may pass down on to the sheath; after passing on to the sheath they frequently assume a purplish colour. The width of the streaks varies from about one-eighth of an inch to a fine barely visible line; they may traverse the whole length of the leaf blade and sheath or they may be very short; they may be observed on the youngest leaves. Older streaks become broader and lose their sharpness of outline, develop irregular reddish areas along the streak, and later become withered, the withering usually starting from the margin of the leaf and proceeding inwards. This imparts to the leaf the "scalded" appearance from which the name of the disease is derived. Frequently the withering of the leaf tissues does not take place in damp weather but it is rapid in dry weather, causing the obliteration of the streaks on the leaf blades. Another characteristic is the profuse production of side shoots by diseased canes; these side shoots also bear the typical streaks on the blades and sheaths of the leaves, and are of great value in diagnosis, particularly when the leaves of the main stem are withered. Reddened vascular bundles are common, especially at the nodes.

Acute Phase.—Plants afflicted with the acute form suddenly wilt and die, the general appearance being that of a plant suddenly cut off from its root system. The wilting may involve the whole stool or only certain stalks of the stool. In the acute form it is often difficult to make a positive diagnosis and to do this it is necessary to search the base of affected stools for the side shoots and suckers which bear the very narrow white stripes upon the blades and sheaths of the leaves.

General Remarks.—The disease may be transmitted by means of infected seed, infected cane knives, and by other unknown means in which insects are believed to play a part. The methods recommended for the control and eradication are the same as those recommended in the case of gumming, but it is found that the varietal susceptibility to the two diseases is quite different.

Leaf-scald is reported as being present in Fiji, Australia, Formosa, the Philippines, and Java.

The Plates are of a high order, and commence with two beautiful coloured ones on gumming and leaf scald. These are followed by two anatomical studies, both hailing from Hawaii, namely, the magnificent but diagrammatic transverse section of a cane leaf (by COBB ?), and the longitudinal section of

the growing point of a thin rootlet. The pictures of the diseases add greatly to the value of the descriptions, and have been collected from a wide range of sources. Specially striking are those illustrating gumming, leaf-scald, Fiji disease, downy mildew and STOREY'S streak disease, while those on the effect of lightning are interesting, although the picture of the general scattering of the parts of the plant is not very easy to make out. For the pictures of local diseases the officers of the Colonial Sugar Refining Co. appear to be largely responsible, the introductory Plate on gumming having been prepared under the direction of D. S. NORTH, who is also credited with the photographs of downy mildew. The Philippine Bureau of Science has been drawn upon for five or six photographs, and Hawaiian sources for quite a number. Altogether it is an interesting collection, although of course not complete, and there are not any pictures of germinating spores and so forth, which would mean so little to the practical farmer. The influence of Hawaii in this bulletin is best seen in the bibliography, from the fact that more than half of the 60 references are drawn from publications in that country.

One word of criticism, which almost seems ungracious. Two all too common mistakes are met with : "comprehensive data . . . *is* lacking," and the spelling of discoloration as "discolouration." It may also be re-remarked that the picture of rind fungus does not tend to help in field work : the chains of spores are not likely to be able to hold together in natural conditions, and, if we are not mistaken, the figure given is of the fungus raised in the laboratory, and most probably under a bell glass jar. Comment is reserved on "unfavourable base ratio." The whole subject of base exchange is, perhaps, in too debatable a stage for definite recommendations to be made. We note that the papers drawn upon are Hawaiian.

POJ 2878 IN PORTO RICO. **R. L. Davis.** Agricultural Notes, No. 47, 1929.

This cane was imported into Porto Rico in March, 1927, by the Experiment Station at Mayaguez, and three eyes out of the ten cuttings germinated. These were rapidly extended by the Java water-sucker and the local single eye methods, and by October, 1928, approximately 15 acres had been planted. The original three buds were ratooned, and at twelve months made an impressive show : handsome, well over 8 ft. high and averaging 1½ to 1¾ in. in diameter. The joints were extraordinarily long as judged by other cane varieties, 6 to 7 in. being a conservative estimate. In stooling power the plants left little to be desired. The shoots were large and vigorous, and quite numerous, 20 to 30 being the average in 50 stools. The hybrid wild blood showed up decidedly in this character. POJ 2878 stools as well as or better than POJ 2725.

"Primavera" plantings were made next to 2725 in February and March, 1928. At maturity POJ 2728 was fully two feet taller than 2725 in both plantings. The latter seedling lived up to its reputation of early flowering, and was in full bloom on November 20th, while POJ 2878 showed no signs of flowering on January 22nd. In 13-month old "gran cultura," only two out of 50 canes flowered on December 15th ; and these notes tend to confirm the statements that POJ 2878 flowers late and sparingly. Part of the above primavera was cut for seed in October, and the young ratoons at the date of writing appear to be decidedly superior to POJ 2725, both in height and the numbers of shoots. POJ 2878 is practically immune to mosaic, and inherits resistance to other diseases, but it is susceptible to borers. Still, there is no reason why it should not be tried out on a large scale. Although additional tests are still required, it appears to have juice equal to that of POJ 2725.

C.A.B.

Root Rot in Hawaii.

By C. W. CARPENTER [1]

In resuming the investigation of the cause of cane root rot, after an absence of six years, we found that failure of Lahaina was being considered in " the root disease complex " as due to a combination of several diverse factors. According to the theory of complex, Lahaina did not fail from any one cause primarily but its failure to grow was due sometimes to one factor and sometimes to another. Of the several factors of the root disease complex, the fungus *Pythium aphanidermatum* was but one factor.

Our view, in advancing the *Pythium* concept in 1919, and subsequently, does not harmonize with the idea of a combination of diverse causes in so far as the universal failure of Lahaina is concerned. This universal failure suggests rather a specific cause or series of closely related and interacting factors, causing a specific disease. It is preferred to consider *Pythium* root rot distinct from localized growth failure. We concede that Lahaina cane was and is affected by the several factors of the growth failure complex, perhaps more so than some other canes, sensitive perhaps from the same predisposing factors, yet none of the factors of the complex have been shown to be universally present and active where Lahaina failed, nor has it been claimed by the advocates of these factors that they were more than agents in more or less localized growth failures of Lahaina and other canes, and contributing causes to Lahaina failure.

It does not seem logical to attribute the failure of a variety of cane throughout its range of culture, in remote countries almost simultaneously, to either diverse causes or combinations of unrelated causes. That the variety has seriously deteriorated through senility is not established since it continues to grow vigorously in certain of our local fields, and it almost invariably does well for a time in virgin land. The failure or deterioration phenomena suggest rather the spread of a parasitic disease from country to country and field to field, and the adoption in the several cane areas of practices favouring the attack of the parasite. In the latter contingency, continued cropping may have been a contributing factor, yet the exceptional failures of Lahaina in practically virgin land casts some doubt on the theory of accumulation of harmful products resulting from continuous cropping.

Our investigation is based on the theory that a parasitic organism was the primary factor in the recurrent outbreaks of Lahaina root rot, and that in the historic failure of this prototype we are concerned with a specific disease. The fungus *Pythium* is locally very widely distributed, and since its ability to destroy Lahaina roots and stunt the growth has been repeatedly demonstrated, this organism is considered the active factor.

The year's studies have centred about the following inferences from experiments and observations :—Lahaina cane failed primarily as the result of a specific fungus root rot ; that certain other varieties fail from the same cause, viz. : EK 28, H 146, 20-S-20 ; that H 109, D 1135 and Yellow Caledonia are representative of very resistant varieties which are attacked seriously only under unfavourable growing conditions ; the working theory that susceptibility of cane roots to attack by *Pythium* may be acquired or lost as a function of quality or balance of nutrients, or of absorption of soluble substances.

Various investigators of root rot of cane, corn and other crops have reported a fungus similar or identical with our Hawaiian *Pythium* as the probable cause of root rot. In Louisiana, Edgerton has reported successful

[1] A Report submitted by the Pathology Department of the H.S.P.A. Experiment Station, as printed in the Station Report for the year 1927-28.

inoculations with a cane *Pythium*, and resulting root rot of cane, corn, oats, wheat and sorghum.

Nearly ideal growing conditions during the year were reflected in marked absence of root disease of the Lahaina failure type in our commercial canes. Diseased areas of *Pythium* root rot type suggesting Lahaina failure in general characteristics, which in past seasons have caused some apprehension, were not conspicuous. This type of growth failure, in which *Pythium* is an associate, has been more common in dry years or periods of unfavourable conditions for growth.

With Lahaina cane adopted as a prototype the investigation of cane root disease has become an intensive probing of the underlying causes of root rot in this variety. We have had the benefit of experimental plantings of Lahaina cane in the Hilo and Hamakua districts of Hawaii for observation. These plots were planted in co-operation with the Experiment Station by the Olaa Sugar Company, Ltd., Honokaa Sugar Company, Pepeekeo Sugar Company and Onomea Sugar Company. Small areas of Lahaina have also been under observation at the Waipio and Kailu sub-stations.

Observations considered significant of progress in the studies are discussed below together with a discussion of the working theory under which the work is being developed. A consideration of varietal idiosyncrasies of nutrition and of absorption of soluble soil materials with the relation of the growth effects of such peculiarities to susceptibility to *Pythium* offers a promising line of research. It is believed that this working theory is fundamentally sound.

Observations in the Hilo and Hamakua Districts.

Lahaina sickness and root rot appeared promptly in varying degree of intensity in all the experimental plots in the Hilo and Hamakua districts. Many of the symptoms as recorded following the failure of Lahaina at Onomea Sugar Company in 1897 have been repeated. Competent observers familiar with the conditions in the past have recognised the disease as the same. In one plot at Onomea Sugar Company, at an elevation of some 300 feet, we have had a fine example of a characteristic of the disease, often remarked by John T. Moir. This plot in Field 34 crosses a small hollow. The disease is worse in the lower portion ; a difference of a few feet in elevation marks the transition from fair Lahaina growth to poor. This condition has been constantly present for over a year.

At Olaa Sugar Company, Ltd., in the plot in Field J-2, we have the most striking failure of Lahaina of the seven plots under observation. Growth has been very slow, with pale green to yellow colour of leaves and general lack of water or starvation symptoms. Few leaves, fan wise, at the tops of short jointed, weak sticks. The stools are easily lifted from the soil. The Lahaina is in most remarkable contrast to the adjoining Yellow Caledonia. In some plots, as in Field 29, at Honakaa Sugar Company, the Lahaina growth compared favourably with standard canes near by. The stand was thin in portions of the area and stooling was restricted. Root rot though present was never observed to be more than moderately active in this plot.

In Field 1, at Pepeekeo Sugar Company, Lahaina growth was characterized by a very irregular stand, poor closing in, with moderate to normal growth of some stools. Normal development for the period of growth never occurred. Many stools and groups of stools were very much stunted and badly root rotted.

During the year five inspection trips were made to the plots. Examination of root material and isolation of suspicious organisms were made.

Pythium aphanidermatum and another related form were the only significant fungi almost constantly present. Of a representative fungus flora isolated from these plots comprising fifteen strains, only *Pythium aphanidermatum* produced root rot of Lahaina by inoculation.

This fungus was observed more or less abundantly in the root system of stools from all plots at almost every inspection. Where it was not abundantly present as a rotted root inhabitant, a related form was conspicuous. The significance of this related, though distinct, form has not been determined. Numerous isolations of *P. aphanidermatum* were made and positive inoculations obtained on Lahaina grown in sterilized Waipio soil.

The significant points of this work on Hawaii were that Lahaina still refuses to grow as a commercially successful cane after some twenty-five years of growth of other varieties in the sick soil; and that *P. aphanidermatum* was almost constantly present in the rotted roots, frequently a related form being more conspicuous as an associate.

SOME FEATURES OF *Pythium*.

Soil Reaction.—*Pythium aphanidermatum* grows in pure culture in acid or alkaline media, the tolerated range of hydrogen ion concentration being comparable to that of our local soils. Soil reaction appears to have had little influence on the occurrence of the disease, as the range recorded in the past was from the acid soils of Hamakua to the alkaline soils of Ewa and Puuloa.

Temperature relations.—The fungus was observed to produce its swimming zoospores very readily at a temperature of 60°F. A very rapid and distant spread of the fungus is possible in cool, wet weather. The disease has generally been reported as more active in the fall and winter months, becoming noticeable in the checked growth as the succulent, fast growing cane is subjected to the cool fall weather and winter rains. Drier weather subsequently accentuates the symptoms.

Chemical control.—The control of the active factor *Pythium* appears to be possible in some degree in pot cultures by the use of copper carbonate or copper sulphate as a soil amendment. Unless the controlling factor in susceptibility is brought under control, the use of chemical disinfectants would appear to be of slight and transient benefit as a field treatment. Growth of a crop of Lahaina by the aid of chemical soil disinfectants does not at this time appear feasible.

Occurrence.—The fungus is widespread in our cane fields and it is not an infrequent inhabitant of a few roots of our standard canes. In no case during the year has a root sample come to our attention where the fungus alone appeared to be responsible for appreciable damage to commercial canes. A great many random samples of cane stools, collected by R. H. VAN ZWALUWENBURG in his nematode surveys, were available for examination. Under the prevailing weather conditions our commercial canes have not been observed to be appreciably affected. The recently introduced variety EK 28, from Java appears much more susceptible to root rot associated with *Pythium* than Lahaina. It was a signal failure where Lahaina grows well.

THEORETICAL CONSIDERATIONS.

The environmental factors influential in modifying the intensity of root rot have long been a subject of conjecture. Sudden out-breaks, the scattered areas affected, sharp demarcation of diseased cane at times, the rapid spread of the disease, occasionally followed by as startling phenomena of recovery, have been very puzzling features.

A study of available records allows the following generalizations: The Lahaina trouble started or reached its crises of intensity in dry years, viz.: Onomea Sugar Company—1897; Olaa Sugar Company, Ltd.—1906; Oahu Sugar Company, Ltd.—1905, 1912, 1919; Ewa Plantation Company—1905, 1909, 1912, etc.; Honolulu Plantation Company, 1905, 1912, 1913. The United States weather reports show that these years were record years of low rainfall; for example in the Hilo district, 1897 was the driest year in twenty-four years of record. In the Hilo district the disease was worse in the best soils and in the hollows. On the island of Oahu it was worse in dry years; it first made its appearance near roads, ditches, railroads, etc. The disease was apparently aggravated by disintegrating coral. Fertilizers have not been of any benefit, sick Lahaina showing in general no response to nutrients or agricultural methods.

Although *Pythium aphanidermatum* appeared to be the active causal agent of root rot, the existence of a controlling influence in the environment was long suspected. After many tentative theories as to the nature of this suspected controlling factor were entertained and rejected as untenable, a theory of susceptibility acquired in the soil as a function of quality or balance of nutrients, or absorption of soluble materials was devised.

The general failure of Lahaina to respond to fertilization, combined with the analyses of our chemists showing abundance of plant food and no general correlation of deficiency, strengthened the assumption that there might be excess of some nutrients or an unbalanced condition of nutrients. This belief was further supported by Burgess' statement that there was no shortage of nitrogen, lack of ammonification or nitrification in the poor spots. He commented incidentally, however, that in fact there was almost without exception more nitrogen in the "poor" spots than in the "good" soils.

In March the working theory was devised that susceptibility of Lahaina cane to root rot was acquired or lost in the soil, that the ability of *Pythium* to enter the roots depended upon how the plant was nourished or what it had absorbed. The first assumption was that excess nitrogen developed a susceptible root system. As work progressed preliminary experiments showed that root rot was greatly increased in a certain soil, by excessive applications of sodium nitrate, but that a more marked effect was produced by additions of cane compost, cane trash composted with "Adco," to a virgin soil. It seems more probable that in the field the effect of nitrates may be indirect and that excesses of the by-product of accelerated trash and stool decomposition result in a susceptible type of root growth, rather than that we have excesses of inorganic nitrates sufficient to be harmful. The nitrogen applied furnishes this needed element to the cellulose fermenting bacteria, thus accelerating the formation of the substance which affects susceptibility. This disintegration product may be stimulative in modern amounts, but to amounts above this Lahaina appears very sensitive, and root rot promptly appears. H 109 seems to make better use of high nitrogen and high compost content. Since nitrates in large amounts induce a susceptible type of root growth, we believe the compost disintegration product may be nitrogenous in character.

Under the working theory Lahaina is susceptible to root rot when over supplied with nitrates or products of cane trash decomposition. We assume that varieties differ in their ability to use nitrates, etc., and that in some varieties such as Lahaina, EK 28, etc., a stimulated type of root growth susceptible to *Pythium* occurs with smaller amounts of nitrogenous nutrients than with varieties H 109, D 1135, and Yellow Caledonia.

Theoretically, basing our inferences on our records, and on the preliminary experiments, Lahaina cane grew well in various localities, as long as natural conditions were maintained, just as it grows now for a short time in virgin soils, and in certain fields commercially for reasons we do not appreciate. It is an excellent cane for moderate yields but was not adapted to forcing, at least not in the presence of *Pythium*, and failed to respond to nitrogen fertilization beyond a certain low maximum. Our fields are apparently too high in content of the unidentified disintegration products of cane residues or in nitrogenous material for this variety now. Heavy rains with excessive leaching, remarked in our records as the one unusual precedent condition to remarkable crop recoveries, might restore some fields for this variety if we desired to grow it. This leached condition would probably be temporary, a condition of excess returning in dry weather under modern fertilization and agricultural practices, trash composting in the soil, nitrogen fixation and nitrification.

Java Technical Notes.

MILL BREAKAGES. (*A*) **G. A. D. Emmen.** *Archief*, 1929, **37**, I, No. 10, 315-321. (*B*) **E. C. von Pritzelwitz van der Horst.** *Ibid.*, 1929, **37**, I, No. 11, 331-335.

(*A*) During the 1928 season very many mill breakages occurred in Java, one factory, for example, breaking seven rolls during the crop, another six, two others, three, three others, two, and so on. Soerabaia sugar machinery work shops during May to October furnished 64 mill cylinders, 37 shafts and 75 mantels as replacements. Most of these breakages are said to have involved feed rolls. Different conditions which in milling may affect such a condition of things are the following : (1) a fall-plate improperly adjusted, acting as a kind of ram ; (2) a fall-plate having a very rough surface hindering the even passage of the bagasse ; (3) the fall-plate too short ; (4) rate of the rolls too low in regard to the quantity of bagasse to be worked ; (5) a front opening too small in relation to the cellulose milled ; (6) a front opening too small in proportion to the rear opening ; (7) a trash turner improperly adjusted, the distance between it and the top roll being too small or too great ; (8) unsuitable material for the mantel ; (9) faulty grooving of the mantel surface ; (10) irregular feeding of the cane carrier ; and (11) forcing too great a capacity for the same rate of the rolls. But the greatest danger for all mills is too small a back opening, the result being a powerful pressure on the top roll which may thus break. (*B*) This second writer challenges the statement that most of the breakages were feed rolls. He states that with milling installations with and without these feed rolls there is little difference in the number of breakages. Thus during the season concerned there were 181 breakages in 388 mills with feeding rolls and 117 breakages in 279 mills without feeding rolls, or 47 and 42 per cent. respectively. These figures relate only to general mill breakages, but if they are confined only to roller breakages (excluding damages to mantels, shafts, bedplates etc., as should be done) then the roll breakages without feeding rolls work out at 77 per cent.

FILTRATION IN CANE SUGAR FACTORIES. **P. Honig.** *Archief*, 1929, **37**, I, No. 15, 420-431, 437-454.

This is a general article dealing with the problem of filtration in cane sugar factories, in which the author sketches in the first part some filtration theories, and in the second gives descriptions of modern filters, including Sweetland,

Vallez, Cantilever, Polysius, Babrowski, Oliver, F. E. Inc., Dorr, and Gröppel apparatus. Following are some figures giving the cost of filtration per quintal of sugar for Olivers and filter-presses :

	Waipahu (Hawaii) 1926		Baragua (Cuba) 1927		Java 1928
	Oliver	Filter-press	Oliver	Filter-press	Filter-press
Labour	0·75 Holl. cts...	1·41 ..	0·390 ..	1·52 ..	0·60
Cloth	0·2 ..	1·85 ..	0·150 ..	1·90 ..	2·60 [2]
Phosphoric Acid......	0·4 ..	0·25 ..	2·400 [1] ..	— ..	—
Lime................	— ..	— ..	0·350 ..	— ..	—
HCl	0·15 ..	— ..	0·065 ..	— ..	—
Repairs	0·075 ..	— ..	0·016 ..	— ..	—
	1·575 ..	3·51 ..	3·371 ..	3·42 ..	3·20
Cost of sugar losses [3] ..	1·730 [4] ..	5·23 [5] ..	0·900 [6] ..	4·27 [7] ..	5·33 [8]

At the Waipahu factory of the Oahu Sugar Co. an Oliver filter was in use the whole campaign, this having a filtering surface of 33 sq. m., and giving the following daily average figures : muddy juice, 17 per cent. of the raw juice ; muddy juice worked, 149·1 tons, thickness of the filter-cake, 7 mm. ; mud separated, 28 tons ; water content of the Oliver mud, 82·24 ; and of the press mud, 73·45.

Some general data on filtration, the average of Java carbonatation factories and of two factories in that country, are as follows :—

	Sq. m. of f.s per 1000 of cane.	Kg. of filter-mud per sq. m. of f.s. in 24 hours.	Polarization of the filter-mud.	Filter-mud per cent. crystal.	Polarization loss in mud per cent. crystal
Average Java carbonatation factories	32 ..	211 ..	1·1 ..	54·0 ..	0·7
Goenoengsarie s.f.	28 ..	357 ..	3·5 ..	106·5 ..	3·7
Semboro s.f	39 ..	260 ..	3·1 ..	116·5 ..	3·6

Further, some analyses are given of filter-cloths (carbonatation and defecation) which had been in use for a sufficient time to become incrusted, the ash content of the defecation cloth being as high as 38·37 per cent. It is very probable that the fibre exhibits an adsorption effect towards the mineral matter in this juice. Prepared filter-cloths ("Metacloth" and "Thoratex" impregnated with some metallic salt) have been put on the market, the quality of which alters very little with use.

Improvement of the Quality of White Sugar. **J. Deinema.** *Archief*, 1929, **37**, I, No. 20, 517-526.

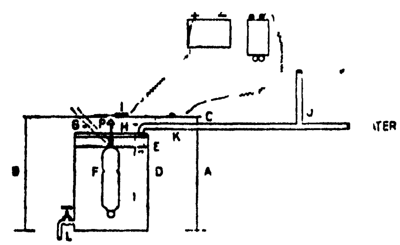
Efforts are being made in Java to improve their white sugars, which are admitted to leave something to be desired. Until a few years back, *A*, *B*, *C*, and *D* sugars were together classed as "superior," but now with the changed market a really superior white is being demanded. In a recent publication of Dr. Honig, it was advised that only evaporator syrup (thick-juice) and *A*-syrup (first green) should be boiled to white sugar without special purification. *B* and *C* syrups are really too low in purity to be boiled in, whilst re-melted *C* and *D* sugars though giving sufficiently pure remelts contain too much suspended matter to be used as such. As for the cost of re-melting the sugars in this way, whether a greater pan capacity and more fuel will be required, it is not possible to state the position beforehand ;

[1] Per q. of sugar 0·17 kg. DSP. [2] This varied from 1·3—4·0 ct. per q. of sugar (cf. *Archief*, 1925, IV, p. 124). [3] Assuming f 7—per q. pol. in filter scum. [4] Polarization filter scum 1·1. [5] Polarization filter scum 4·5. [6] Filter scum 0·8 Pol., 77.0 per cent. water. [7] Filter scum 5·0 Pol., 67·0 per cent. water. [8] Average filter pol. 5.4 ; filter scum per cent. crystal = 14 ; pol. loss in filter scum per cent. crystal = 0.8.

but some compensation should be obtained from the smaller quantity of clearing syrup and of covering water and steam. Neither extra pan capacity nor fuel, however, was required by the author when following the new method during the past two crops. As for the medium for the re-melting, clarified juice may be used, and it will be found to give a liquor having a *pH* of about 6·0. After neutralizing with milk-of-lime, and heating to 75°C., the liquor is filtered with the previous addition of kieselguhr, paper pulp, or the like. But preferably treatment with lime and phosphoric acid should be combined with the filtration, this giving a decolorization of 20-30 per cent. Of course more than this decolorization will be realized if an after-filtration through active carbon be made. Working with remelts in this way, a *S.H.S.* (superior first sugar) of a better colour, and a more regular grain than formerly, has been obtained in the Kedoeng Banteng s.f., as figures tabulated in the original article certainly show.

AUTOMATIC INDICATION OF SUGAR IN BOILER FEED WATERS. **Ch. L. Warendorf and F. W. Venema.** *Archief*, 1929, **37**, I, No. 20, 526-531.

A special spindle is the principal element of the apparatus used. It is capable of showing the slightest alteration in the density of the water, and is made of aluminium, 30 cm. long. Its proportions are such that it is capable of rising the following heights in the presence of increasing small amounts of sugar : 2·5 mm., 1 per cent. ; 4 mm., 0·3 per cent. ; 6 mm., 0·5 per cent. ; 8 mm., 0·9 per cent., and 11 mm., 1 per cent. This spindle is placed in an electric circuit with a copper plate placed above it, so that with a certain increase in the density of the water caused by the presence of sugar it rises, the top of its stem completing the circuit and ringing a bell, showing a light, or making both signals. Turning to the drawing, this shows the spindle at



F, in a tank *D*, the top of the stem of the spindle having a metal cap *P*, above which is the copper plate *I* At *G* is a support for centring the spindle. One can see that when, owing to the increasing density of the water, the spindle rises a certain height (fixed by calibrating the apparatus at a certain temperature with water containing known amounts of sugar), it then completes the electrical circuit between the copper plate *I*, the battery and bell, and the cap of the spindle by way of the very fine wire *H*. For the purpose of calibrating the apparatus, which in practice is fed from a branch pipe taken from the line fed by the boiler feed water pump, either water or juice can be introduced into the tank *D* through the opening *E*. By means of the cock *L* a constant level can be maintained, and it is self-evident that the apparatus must be used at the temperature at which it is calibrated, which in the authors' factory, Ardjawinangoen, is 90 to 94°C.

APPLICATION OF DECOLORIZING CARBONS TO REFINING IN JAVA. **P. Honig and J. F. Bogtstra.** *Archief, Mededeelingen*, 1929, No. 5, 231-285.

This article forms in fact a fairly complete monograph on the application of decolorizing carbons in the cane industry. Chapter I gives general fundamental data on carbons ; II is an historical review of work done in Java in 1916 in four factories, using "Norit," it being shown that results could be obtained only on remelted sugar. ; III, a sketch of work done elsewhere,

principally in America; while IV is devoted to the main object in view, namely a description of the recent trials made at the Somobito carbonatation s. f., Java, with the powerful material "Carboraffin," which is applied without revivification. A summary of these trials will now be given. Molasses sugar, D. S. 20, and polarization, 98·1, was dissolved in clarified juice to 60° Brix, after which it was submitted to the following operations: (1) a preliminary clarification, consisting of the simultaneous addition of lime and phosphoric acid (0·65 per cent. of the solids), followed by kieselguhr (1·35 per cent. of the Brix solids), after which the liquor was passed through Scheibler bag filters; and (2) the actual "Carboraffin" treatment, which took place according to the layer filtration method in four Scheibler filters (each 19 sq. metres) in parallel, each containing 38 kilos. of the carbon, one filter being changed daily. A final check filtration through some old presses, using paper pulp as medium, was given at first, but later was found to be unnecessary. Careful analyses of the liquors were made at various stages throughout the process, colour observations being made, for example, by means of the photo-spectrometer. It was concluded from these trials that the method of working outlined provided a liquor giving a very good white granulated sugar when boiled to grain, a sugar equal to European refined. But it was noticed further that the preliminary clarification had a share in this result. The filtrate after the lime, phosphoric acid and kieselguhr treatment was boiled to grain, and found to give a sugar which after it had been carefully washed was also very good. In fact the decolorizing action is ascribed principally to the effect of the calcium phosphate precipitate in the preliminary clarification. Figures stating the amount of "Carboraffin" consumed in these trials are unfortunately not given, though other very numerous data are presented.

Remarks on Boiling in White Sugar Production. **C. D. Duvekot.** *Archief*, 1929, **37**, I, No. 18, 266-269.

Firstly the circulation must be such that the massecuite always remains homogeneous during boiling, and the same temperature prevails through the whole mass. If homogeneity of the mass, and uniformity of its temperature are secured, one avoids chances of local superheating and sugar decomposition, which is so destructive to the colour and regularity of the crystal. Secondly, the duration of boiling must be as short as possible, since even if the above conditions are fulfilled there is always some darkening of the syrup during boiling. Thirdly, in regard to regularity of grain, the author believes this to depend in the first place on clarification and in the second place on boiling. Fourthly, the crystal must be sufficiently hard to withstand movement whilst in apparatus such as shaking gutters or Jacob's ladders. Hardness also is said to depend mainly on clarification, but it is of course also influenced by the temperature and the duration of boiling. Then follow some remarks on the design of the pans, it being at once stated that calandria are decidedly preferable to coils as heating systems, and for the following reasons: Circulation is better, since the heating body is without harmful openings between coils and iron supports. Duration of boiling is shorter, as one can use the whole heating surface immediately, besides which the condensed water can be more quickly removed, leading to a better heat transmission. Manipulation is simpler, so that the pan-man can give more time to the actual boiling. Steaming out can be more easily done; and there are not more than two steam traps. And lastly, the initial cost of calandria pans is lower, steel tubes sufficing in place of the more costly copper coils.

British Beet Factory Annual Reports.

The annual Reports of the principal British beet sugar factories have been issued somewhat later this year than was the case in preceding seasons. Below we give the particulars of those to hand.

Ely Beet Sugar Factory, Ltd.—This factory worked satisfactorily during the past manufacturing season. Contracts were made with 2567 growers for 21,338 acres of roots (as compared with 2760 growers for 22,492 acres in 1927-28). The average sugar content of the beet received was 16·50 per cent. (against 15·13 per cent.) The growers received for their beet an average price of 49s. 1d. per net ton delivered, (against 53s. 1d. in 1927-28). After providing for the usual charges, and transferring £58,983 to general reserve (as against £46,211), there was a balance of net profit shown of £56,250 (the same as in the two previous years), and the Directors again propose paying a dividend of 12½ per cent. free of tax.

English Beet Sugar Corporation, Ltd.—A satisfactory working of the Cantley factory is also reported. Contracts were made with 2478 growers for 22,128 acres of roots (as compared with 2880 growers for 24,898 acres in 1927-28). The average sugar content was 18·40 per cent. (against 16·35 in 1927-28). The growers received for their roots an average price of 55s. 4d. per net ton delivered (against 56s. 2d.). For the sixth year in succession the Company has operated the Kelham Factory of Home Grown Sugar, Ltd., and the profit under the agreement was divided as follows: To Home Grown Sugar, Ltd., £15,484; to the Company, £7742 (against £40,030). After providing for the usual charges, and transferring £3807 to general reserve (against £69,925), there was a balance of net profit of £100,000 (as last year) and 20 per cent. free of tax is being paid on the ordinary shares, which will absorb the balance shown.

Home Grown Sugar, Ltd.— The ninth annual report of this company states that the Kelham factory has had a satisfactory season, Contracts were made with 1111 growers for a total of 5185 acres (compared with 2228 growers for 10,177 acres in 1927-28). The average sugar content of beets received was 17·36 per cent. (against 16·64), and the growers received for their roots an average price of 52s. per net ton delivered (against 56s. 10d.). The share of profit due to this Company under the working agreement with Cantley was £15,483, while the profit upon the estate and farm was £3156. After providing for all charges and for interest on the Bank Loan there is a credit balance of £11,245. In order to allow depreciation upon the factory buildings and plant, and to pay a dividend of 5 per cent. on the shares held by the public without recourse to the Government guarantee, a further sum of £17,526 was required, which was taken from the general reserve account, thereby reducing the latter to £87, 667. The bank loan has been reduced from £69,675 to £50,915.

Ipswich Beet Sugar Factory, Ltd.—A satisfactory manufacturing season at the Ipswich sugar factory is reported for 1928-29. Contracts were made with 1066 growers for 11,577 acres of beetroots, as compared with 1225 and 13,084 acres in the preceding season. The average sugar content of the beet received was 18·14 per cent. (against 16·65 per cent.), and the growers received for their beet an average price of 54s. 6d. per net ton delivered (against 56s 10d. in 1927 and 62s. in 1926). After providing for the usual charges and transferring £640 to general reserve, there was a balance of net profit of £50,000, the same as in the two preceding seasons; and a dividend of 12½ per cent. free of tax is being paid.

King's Lynn Beet Sugar Factory, Ltd.—The second annual report of this factory records a satisfactory working year. Contracts were made with 1004 growers for 11,587 acres of roots, as compared with 669 growers for 5635 acres in 1927-28. The average sugar content was 17·24 per cent. (against 16·85), while the growers received an average price of 51s. 6d. (against 54s. 4d.) per net ton delivered. After providing for all charges and transferring £836 to general reserve, there was a balance of net profit of £36,000 (against £45,000), which is being applied in payment of a dividend upon the ordinary shares of 8 per cent. free of tax (against 10 per cent. free of tax).

Lincolnshire Beet Sugar Company, Ltd.—The second annual report of the Bardney sugar factory shows that the net profit after providing for debenture interest, depreciation and income tax, is £11,284, which sum with £1,486 brought forward from last

year is carried forward to next account. No dividend is proposed on the preference shares. This compares with the results of the first year when, after placing £25,000 to depreciation reserves and the like amount to write off preliminary expenses, and providing for debenture interest, and other charges, there was a net balance of £26,120 which allowed 7 per cent. to be paid on the cumulative preference shares.

Anglo-Scottish Beet Sugar Corporation Ltd.—For the year ending March 31st last a net profit of £10,686 (as against £44,811) is shown, after providing for depreciation, interest, income tax and all trading charges. With the balance carried forward from last year of £87,130 (as against £43,819) the credit at profit and loss account amounts to £97,816 (as against £88,630) which the Directors recommend to be carried forward to next year, as owing to the conditions attached to the guarantee by H.M. Treasury of the 5 per cent. Second Debenture Stock, the Directors are precluded in the meantime from recommending payment of a Dividend on the Share Capital; but in any case owing to the uncertain outlook with regard to the future they would not have recommended any distribution at this time. The trading results for the year have suffered owing mainly to the shortage in the acreage secured for the beet crop, the poor tonnage yield on account of the bad season, and to the low price of sugar. The acreage booked for the 1929 crop shows a substantial increase from last year, but the low price of sugar continues. During the year the instalments, amounting to £61,000, towards the repayment of the first and second Debenture Stock were duly met.

Second Anglo-Scottish Beet Sugar Corporation Ltd.—The total at credit of profit and loss account for the year ended March 31st, 1929, including £21,495. 17s. 2d. brought forward from last year, amounts to £18,528. 10s. 1d. (as against £26,591 last year) which it is proposed to carry forward, subject to payment of Directors' fees. No addition has been made to the Depreciation Account which remains at the same figure as last year, viz., £140,000. The trading results for the year have suffered owing mainly to the shortage in the acreage secured for the beet crop, the poor tonnage yield on account of the bad season, and to the low price of sugar. The acreage booked for the next crop shows a substantial increase from last year.

West Midland Sugar Company, Ltd.—The net profit for the year ended March 31st, 1929, of the Kidderminster factory, after providing for Depreciation, Interest, and all trading charges and provision for income tax, is £33,560 (as against £57,946 last year); to this is added the balance brought forward of £36,004 (as against £35,559 last year) which makes the total at credit of profit and loss account £69,565 (against £93,505). The Directors recommend a dividend of 10 per cent. free of tax (against 12½ per cent.), absorbing £18,000 and carry forward the balance of £51,565. Trading results have suffered owing to the low price of sugar.

Central Sugar Company Ltd.—The Peterborough factory which was started in 1925, reports a net profit of £93,871 for the year to 31st March, 1929, compared with £77,987 for 1927-28. Debenture interest takes £4310 (against £6538), depreciation absorbed £20,650 (against £21,885), and income tax £25,308 (against £20,000). The dividend is maintained at 10 per cent., tax free, leaving a carry-forward of £69,587, compared with £43,484 brought in.

Beet Loading.—An arrangement combining high grabbing output with exceptional mobility is said to be found in the Priestman "Universal" excavator mounted on a Four Wheel Drive Lorry.[1] The grabbing machine weights nearly 7 tons, and can lift 6 cwt. of beet at a time. It can load a dump in a short space of time, and can rapidly travel to the next heap for operation there.

Beet Stands.—In France before the war the number of beets per hectare was 72,000, and now the figure is 62,000, points out Mr. E. Saillard.[2] But the seed used is also less, being 20 kg. (18 lbs. per acre) as compared with 25 kg. (22 lbs. per acre). It is possible this decrease has something to do with the higher costs of labour, but the cost of seed during the post-war period has certainly had an influence as well. It is a doubtful economy anyway, and trials by factories having farms are urged to more thoroughly examine the question, which really is an important one.

1 *The Commercial Motor*, 1929, 770-772. 2 *Supplément à la Circulaire, No.* 2086.

Beet Agricultural Notes.

English and German Costs.—In a recent lecture at Ipswich, Colonel GERALD LONG gave some instructive figures of the relative cost of beet cultivation in this country and in Germany. Dealing first with German costs, he said one could not fail to be struck with the efficiency of German labour and particularly that of the casual workers. The casual labour, which was mostly imported from Czechoslovakia, was done by women. They did their work well and got over it very quickly. The whole of the horse work on the farms in Saxony for sugar beet cultivation was done by the permanent staff, the wages of the permanent horsemen being 15s. to 20s. a week in cash, in addition to which they had a free house, a thousand pounds of wheat, an acre of land, or as a substitute potatoes. On a cash basis this worked out at about 26s. a week of sixty hours. That meant 5½d. an hour, which was 2d. less an hour than was paid to farm hands in this country.

The casual women workers also had a sixty-hour week for 30s. a week wage, which worked out at 2½d. an hour; this was not all paid in cash. These women did more hoeing in a day than the regular farm hands in this country, and this went to show how it was possible for the German sugar beet grower to keep his costs down. Colonel LONG next went on to compare the complete costs of sugar beet in Germany with those prevailing in East Anglia. The German labour cost for the whole operation of sugar beet growing came to £7. 2s. per acre, which was against £10. 8s. per acre that he (Colonel LONG) incurred. While the German farmer placed his beet 18 in. apart, it was a practice in this country to put them 24 in. apart. The Germans valued their land at £2. 8s. an acre, where his (Colonel LONG'S) land could be put at £1. 6s. an acre. Even so, the total cost per acre to the German grower was £18. 2s. per acre, against £20. 6s. in this country.

Kirton Trials.—The Agricultural Institute, of Kirton, Lincs., publishes each year the results of trials of stocks of sugar beet seed,[1] and their report for 1928 (Extension Leaflet 10) has now appeared. In this it is remarked that a comparison of the same strains of sugar beet grown on the Continent and in England will usually show about 30 per cent. more foliage under English conditions. The percentage of sugar is on the average higher on the Continent than it is in England. So also is the average yield of roots, but this would appear to be due to the English growers' lack of experience in growing the crop. The soil on which the trials were carried out is typical of the bulk of the land in the Holland Division of Lincolnshire, being a deep alluvial loam; the previous crop was cereals; the land was subsoiled; no farmyard manure or artificial was used, but 10 cwt. of ground limestone was worked into the surface layer. Seed was drilled on April 24th and 25th at the rate of about 30 lbs. per acre; the width between the rows was 18 in.; and the trials occupied nine acres, each plot being in duplicate with a control stock between each plot. The sugar percentage was satisfactory, being on the average about 2 per cent. above that of 1927, the percentages in both original and duplicate plots being generally consistent. "Bolting," unless prevalent, is not a very serious factor, but even a small percentage is unsightly. A high percentage may very seriously reduce the returns per acre. It was more prevalent in 1928 than in 1927. As in previous years, the dwarf types, i.e., Dutch and Swedish types, threw fewer bolters than the stronger growing types. Polish stocks have in previous years bolted badly. Of three stocks sent in in 1928 specially for testing for bolters, one stock was quite satisfactory. There are several types of roots: French are usually long and tapering;

[1] *I.S.J.*, 1927, 93, 143; 1928, 102.

Kirton Trials of Sugar Beet Seed, 1928.—1st Series (Light Land).

Stock	Country of Origin.	Sugar Content. Per Cent.	Bolters per Acre Counted. July	Sept.	Tared Yield per Acre. T.	c.	qr.	lbs.	Returns per Acre *less* Carriage at 3s. 2d. per ton. £	s.	d.
Horning H.1.—from Anglo-Scottish Beet Corporation	England	18·6	120	680	14	8	3	6	38	2	11½
Kuhn—from Anglo-Scottish Beet Corporation	Holland	19·8	—	180	12	19	3	8	36	18	1½
Perfection—from Anglo-Scottish Beet Corporation	England	20·0	120	700	12	7	0	6	35	10	3½
Perfection—Johnson & Son, Boston	,,	19·0	120	800	11	11	2	2	31	7	0
British Hilleshog No. 1—Marsters, King's Lynn	,,	20·8	—	40	11	18	1	26	35	17	6
Hilleshog 27a—Swedish Sugar Trust	Sweden	20·9	—	340	12	8	3	25	38	18	1½
Garton's No. 1	England	20·1	240	760	12	9	3	8	36	2	2½
Garton's No. 2	,,	21·5	60	240	12	15	3	11	39	19	6
Webb's	,,	21·3	—	120	12	12	2	0	39	0	7½
Glostrup SK.—Hartmann, Copenhagen	Denmark	19·2	60	100	15	2	1	8	41	8	10
Glostrup KG.—Hartmann, Copenhagen	,,	19·6	180	680	13	6	1	20	37	8	3
Vilmorin B	France	20·7	120	960	13	0	1	12	38	18	11
Buszczynski NM	Poland	21·0	1920	4720	9	9	1	14	28	16	1
Delitzscher—from Anglo-Scottish Beet Corporation	Germany	18·7	180	760	14	12	0	6	38	16	5
Braune—from Anglo-Scottish Beet Corporation	,,	18·8	360	1140	14	16	1	0	39	12	6
Dippe E.—from Anglo-Scottish Beet Corporation	,,	18·3	380	1420	14	12	3	22	37	19	2
Mette Z	,,	20·7	500	1480	14	16	3	14	44	8	2
Mette SP	,,	19·2	60	820	15	11	0	8	42	12	8
Strube E.—from Anglo-Scottish Beet Corporation	,,	18·9	720	1340	14	19	0	12	40	5	1
Strube Z	,,	20·4	480	1000	12	16	2	2	37	14	7
Schreiber—from Anglo-Scottish Beet Corporation	,,	21·0	240	660	13	9	0	12	40	18	7
Schreiber SS	,,	20·4	240	640	12	7	0	16	36	7	0½
Knoche Z	,,	18·2	—	180	14	17	2	10	38	6	4
Knoche E	,,	20·0	120	1020	14	4	0	2	40	16	6½
Klein Wanzleben Z—from Anglo-Scottish Beet Corp.	,,	20·4	60	540	15	19	0	12	46	18	9
Klein Wanzleben E.—from Anglo-Scottish Beet Corp.	,,	19·4	60	280	16	17	0	16	45	15	6
Dobrovice—from Anglo-Scottish Beet Corporation	,,	20·3	120	880	15	3	2	8	44	7	11
Bergmann—from Anglo-Scottish Beet Corporation	,,	19·6	720	1020	14	9	1	24	40	12	10
Zapotil	Czechoslovakia	18·6	420	980	14	5	3	16	37	15	2½

Kirton Trials of Sugar Beet Seed, 1928.—2nd Series (Heavy Land).

Stock	Country of Origin.	Sugar Content. Per Cent.	Bolters per Acre Counted. July	Bolters per Acre Counted. Sept.	Tared Yield per Acre. T.	c.	qr.	lbs.	Returns per Acre less Carriage at 3s. 2d. per ton. £	s.	d.
Horning H.1.—from Anglo-Scottish Beet Corporation	England	19·2	180	580	11	1	1	10	30	6	10
Kuhn—from Anglo-Scottish Beet Corporation	Holland	20·0	—	60	12	14	2	6	36	11	10
Perfection—from Anglo-Scottish Beet Corporation	England	19·8	—	700	14	1	1	0	39	19	2½
Perfection—Johnson & Son, Boston	"	19·2	—	780	14	5	0	10	39	1	7½
British Hilleshog No. 1—Marsters, King's Lynn	"	20·4	—	—	14	12	2	10	43	0	8
Hilleshog 27a—Swedish Sugar Trust	Sweden	20·0	—	120	14	15	0	20	42	8	8
Garton's No. 1	England	18·9	420	900	13	11	3	4	36	11	6
Garton's No. 2	"	21·0	—	200	13	14	0	12	41	13	9
Webb's	"	20·8	—	60	14	8	1	21	43	7	8½
Glostrup SK.—Hartmann, Copenhagen	Denmark	19·2	—	80	15	1	0	23	41	5	11
Glostrup KG.—Hartmann, Copenhagen	"	19·6	300	780	12	8	0	25	34	17	1½
Vilmorin B.	France	19·3	180	820	14	17	1	13	41	0	3
Buszczynski NM.	Poland	19·4	1800	4180	11	11	0	16	31	13	9
Delitzscher—from Anglo-Scottish Beet Corporation	Germany	19·4	—	380	15	13	1	26	43	9	11
Braune—from Anglo-Scottish Beet Corporation	"	20·2	120	940	13	16	0	18	39	3	1½
Dippe E.—from Anglo-Scottish Beet Corporation	"	19·6	180	1060	16	13	0	4	46	15	3½
Mette Z.	"	20·5	360	980	15	8	0	4	45	11	3
Mette SP.	"	19·7	360	800	14	5	2	14	40	6	10½
Strube E.—from Anglo-Scottish Beet Corporation	"	19·0	540	1040	15	8	1	6	41	15	0
Strube Z.	"	19·2	60	580	14	4	0	23	38	19	3
Schreiber—from Anglo-Scottish Beet Corporation	"	19·2	180	540	14	14	1	4	40	6	10
Schreiber SS.	"	20·4	180	600	14	2	2	15	41	1	5
Knoche Z.	"	20·7	120	240	14	12	3	22	43	16	2½
Knoche E.	"	19·5	180	700	14	15	3	26	41	6	4
Klein Wanzleben Z.—from Anglo-Scottish Beet Corp.	"	20·5	60	240	15	3	1	26	44	17	9
Klein Wanzleben E.—from Anglo-Scottish Beet Corp.	"	20·6	60	500	14	15	0	0	43	17	7½
Dobrovice—from Anglo-Scottish Beet Corporation	"	20·0	120	580	14	15	1	22	42	9	5
Bergmann—from Anglo-Scottish Beet Corporation	"	20·3	—	580	14	3	0	4	41	7	10½
Zapotil	Czechoslovakia	19·2	120	720	18	10	1	22	51	5	7½

German types generally somewhat shorter, but are broader; whilst Dutch and Swedish types are usually rather short, but are broad at the top and for a considerable way down the root. The latter types also produce less foliage than the other types. Following are dwarf types: Kuhn & Co.—Dutch; Johnson & Son (Perfection)—English-grown Kuhn; Hilleshog—Swedish; British Hilleshog—English-grown Swedish; whilst Glostrup—Danish, is intermediate in the amount of foliage produced. In previous years the dwarf types of beet have given better results than the stronger growing types. This may be accounted for by the fact that the stronger growing beets produce, in an average season, too much foliage, at least in the Holland Division of Lincolnshire. In 1928, the dwarf types have not given as good results as the stronger growing types. They have done better in the second series, but, even there, are not quite up to several of the other stocks. 1928 was a very dry year, and this may account for the difference in the results in comparison with previous years. Summarizing, as may be seen from the tabulated matter, English-grown seed has given as good results as Continental-grown seed of the same stock.

Beet Factory Technical Notes.

Sugar in press-cake.—Dr. CLAASSEN, the well-known Manager of the Dormagen s.f., and author of the standard textbook, published in 1922 a paper in which he called attention to a remarkable discrepancy in results for the determination of sugar in carbonatation scums.[1] In his factory the filter-press cake instead of being directly sent out of the factory is mashed up with water, and the thin paste pumped away. He had found the sugar content of the thin paste to be distinctly higher than that of the undiluted press-cake (both on the dry substance). He was at a loss to account for this difference, which had a not inconsiderable bearing on the undetermined sugar loss of his factory. And he had referred the matter to the late Dr. HERZFELD, Director of the German Institute for the Sugar Industry, Berlin, who, however failed to find a higher figure for the diluted press-cake.

Now the matter has been taken up by Dr. O. SPENGLER, the present Director of the Institute, who has conducted a considerable amount of research on it on the spot at Dormagen.[2] He took 300 grms. of the press-cake, triturated it for half-an-hour with 1200 c.c. of water at 95°C., filtered and washed it, and determined the sugar in the total washings obtained. He found a figure of 1·4 per cent. for the original cake (using the usual ammonium nitrate method), and one of 1·96 (about 40 per cent. more) for the sample which had been diluted as described. Further experiments in which the time was lengthened gave an increased difference, until after one hour's mashing figures approaching that of Dr. CLAASSEN (about 166 per cent. difference) had been found. Now as to the explanation of these results: It was observed on examining the Dormagen press-cake microscopically that in addition to the crystals of calcium carbonate there were present large particles of a slimy character, which showed up distinctly on staining with eosine. This colloidal material had retained the sugar to such an extent that it could not be wholly removed by washing; only after mashing with hot water for a sufficient time could it be removed. These observations are of not a little importance regarding the question of the determination of sugar in press-cake, and they

1 *Centr. Zuckerind.*, 1921-22, 703. 2 *Zeitsch. Ver. deut. Zuckerind.*, 1929, 61-76.

explain much that was difficult to understand in the recent controversy on this question.[1] Moreover, they uphold the work carried out by ORTH,[2] who found a higher sugar content by the method of totally dissolving the scums in acetic acid than by the method usually applied in beet factory chemical control.

Continuous carbonatation.—Three carbonatation tanks, one of which serves as a spare, are interconnected in such a manner as to permit continuous operation, the juice, lime and gas being supplied simultaneously and the amount controlled electrically.[3] The electrical controller is adjusted to the particular resistance corresponding to the desired alkalinity, and it operates the gas valve so as to maintain this resistance. Compared to the usual method of batch carbonatation, this Dorr system is said to represent a great simplification, the alkalinity of the finished juice being kept uniform within much narrower limits than is ordinarily possible. A feature of the new system is the re-circulation of juice within the carbonatation unit, which has a very favourable effect on the properties of the precipitate suspended in the re-carbonatated juice. This is modified in form and settles rapidly so that it may be clarified in a special continuous Dorr tray thickener occupying small floor space.

Here the settling of the juice takes place in a series of superimposed compartments in a covered and lagged cylindrical tank. The clear juice overflows at the top of each of these compartments; the mud is continuously raked to the centre of each compartment and withdrawn by means of a "DorrCo." diaphragm pump. It passes to a sludge storage tank and thence to "DorrCo." filters, on which the precipitate is collected and washed and finally discharged into the lime sewer. Appreciable savings in both installation and operation are made, and compared with the ordinary system the following are the economies realized in a non-Steffen house in the U.S.A., based on an average slicing of 1600 tons of beets per 24 hours:—

Labour	$28
Sugar in lime-sewer	57
Evaporation cost (wash-water)	15
Muriatic acid	5
Filter-cloth	23
Increased production	67
Total savings per day	$195

Bardney and Brigg.—These two factories belonging to the Lincolnshire Beet Sugar Company, Ltd., and the Second Lincolnshire Beet Sugar Company, Ltd., respectively, were built under contracts with Sir Robert McAlpine & Sons from designs by the Dyer Company of America, whose experts supervised the erection of the machinery. The first factory, which has a guaranteed capacity of 1000 tons of beet per day, was erected in 1927; the second, rated at 700 tons a day, was put up in 1928. Both factories have proved themselves able to work at nearly 30 per cent. above their guaranteed capacity. The general arrangement of the machinery is very similar in both factories, except that at Bardney Oliver-Borden thickeners and Oliver vacuum filters are used, whereas, at Brigg, the usual plate-and-frame filters are installed. Apart from this, the processes employed in the two factories are much the same and indeed follow the general practice.

It may be noted[4] that at Bardney after completion of the first carbonatation to the desired point (0·06 to 0·12 per cent. CaO), the treated juice is

[1] *I.S.J.*, 1925, 335; 1927, 225. [2] *I.S.J.*, 1927, 559.
[3] *Facts about Sugar*, 1929, 24, No. 15, 352-355.
[4] *Journal of the Ministry of Agriculture*, 1929, 35, 1030.

pumped through a heater to the first thickeners, leaving a thick mud, which passes to drum-type vacuum filters. The first press juice after the second carbonatation (this time to 0·01 to 0·025 per cent.) goes through heaters to the second thickeners and vacuum filters, giving second press juice, which is sulphited, and subsequently sent to the evaporators. The syrup obtained on leaving the effect is mixed with the re-melt sugar, and the mixture pumped to the thick-juice sulphuring station. In the vacuum pans, it gives "white massecuite," which on centrifuging yields white crystals and "high green" and "high wash," the former being boiled to give the re-melt sugar, and the latter going back to the next white pan. These two Lincolnshire factories are electrically equipped throughout.[1]

Carbonatation end-point.—In their previous paper on the important matter of the optimum end-point in carbonatation, and especially its bearing on the question of the reduction of the lime-salts to the minimum possible,[2] O. SPENGLER and C. BRENDEL have represented the three main stages as follows: (1) when the alkalinity is due only to lime and alkalis (potash and soda), thus $CaO + Na_2O$. (2) When on carbonatation the free lime is combined, and the alkalinity is due only to the alkalis, thus $CaCO_3 + Na_2O$, this being the natural alkalinity. (3) When on further carbonatation the alkalis become carbonates, thus $CaCO_3 + Na_2CO_3$, that is the so-called optimum alkalinity, which is the most favourable stage to reach for the precipitation of the lime salts in solution. The stages before and after that point are less favourable for the removal of lime-salts, that is between Na_2O and $NaHCO_3$ (bicarbonate). Now, it should be possible for the chemist to determine volumetrically the Na_2O and Na_2CO_3 in a sample of juice from the carbonatation tank by WINKLER's well-known device of titrating before and after the addition of barium chloride solution. This will be found described in any analytical textbook, the $BaCl_2$ precipitating the carbonate as barium carbonate, leaving NaOH as the only alkaline reacting substance. But experiments have shown that this method, simple as it is ordinarily, will unfortunately not work in beet juices. However, the authors have found a way of qualitatively recognizing the stage at which the alkali hydroxide (NaOH) disappears, and the alkali carbonate (Na_2CO_3) takes its place, and this in brief is as follows:[3] A sample is taken from the carbonatation tank towards the end-point, and from it about 25 c.c. (without filtering or accurately measuring) is poured into a small test-glass. To the still hot liquid, one adds 5 drops of phenolphthalein solution (1 : 100), and 5 drops of a solution of calcium chloride (15 grms. in 100 c.c.). Then, having shaken round the contents of the glass, the colouration is observed after 15 to 30 secs. If this is a dull pink, the carbonatation has reached the correct stage; if colourless, the CO_2 valve is throttled down; whilst if it assumes a distinct pink or red colour, the valve must be opened further. In practice it has been observed that the colour is affected to some extent by the nature of the juices, and that some experience may be required to recognize the point at which NaOH is absent, and Na_2CO_3 only is present. Operators take to the method well in place of the usual titration, and it is advised that it should be given a good trial in order to ascertain whether it is generally applicable.

SUGAR SUBSTITUTE.—*d*-Sorbite, one of the rare sugars, having an agreeably sweet taste, is now being marketed by the I. G. Farbenindustrie, in Germany, as a substitute for ordinary sugar, being sold under the name of "Sionon."

1 See *The Electrical Review*, 1928, 103, No. 2644, 138-143. Also *Food Manufacture*, March, 1929.
2 *I.S.J.*, 1928, 476, 549, 600.
3 *Zeitsch. Ver. deut. Zuckerind.*, 1929, 39-43.

Publications Received.

Evaporating, Condensing and Cooling Apparatus. E. Hausbrand; translated by A. C. Wright, M.A., B.Sc.; now revised by B. Heastie, M.I.Chem.E. Fourth English Edition. (Ernest Benn, Limited, London). 1929. Price: 25s.

This edition, as was the second and the third, has been translated from the second German Edition, but it has now been revised and enlarged by Mr. HEASTIE. He has included an account of the work of Dr. STANTON, of the National Physical Laboratory, and his co-workers, on the principle of fluid flow, thus superseding the empyrical results which until 1916 had been the only available data. This has meant re-writing the section of the book dealing with the flow of steam, water and air through pipes, and re-calculating the tables, excepting where the correction was smaller than the liberal allowance necessary in practical design. Then, the recent researches of Dr. EZER GRIFFITHS on the heat losses due to convection and radiation, also carried out at the N.P.L., have been summarized. Further, a chapter has been added on modern evaporating plant, this illustrating the apparatus of Blair, Campbell & McLean, Ltd., and of others. Lastly, the tables have been revised. In its new form, HAUSBRAND'S book is certainly an improvement, and there is no doubt that it will continue to be the valuable work of reference for the chemical engineer that it has been in the past.

Photometric Chemical Analysis: Nephelometry. John H. Yoe. Volume II. (Chapman & Hall, Ltd., London). 1929. Price: 22s. 6d.

T. P. BLUNT in 1876 suggested[1] that judgment by turbidity might provisionally be termed "nephelometry," and suggested that this method of analysis might be widely extended. And extended very greatly it has been, as this volume shows. Nephelometry offers a means of determining directly the mass or weight of a precipitate in suspension, i.e., without filtering, washing, drying and weighing. The method is based upon the measurement of the brightness of the light reflected by finely divided particles in suspension, very much as in an ultramicroscope. The intensity of the reflected light is a function of the amount of suspended particles, other conditions being kept constant. This principle has been applied to a considerable range of inorganic and organic examinations, and the speed and accuracy possible by this new system are well illustrated in this book by chapters giving detailed descriptions of representative analyses. Nephelometry has been used by LEROY and TAILLANDIER for the rapid determination of reducing sugars.

A Pocket Book for Chemists. Thomas Bailey, Assoc.R.C.Sc.I. Ninth Edition. (E. &. F. N. Spon, Ltd., 57, Haymarket, London, S.W.1.). 1929. Price: 8s. 6d.

"Bailey" is too well-known to need description to our readers. In this, the ninth edition the book has been revised, and sections dealing with mathematical conversions, general, gravimetric and volumetric analysis have been considerably amplified, the matter relating to indicators having been entirely re-written with the inclusion of a comprehensive table of *pH* values. Some data are given on sugar analysis, comprising polarimetric and chemical methods of determining sucrose and reducing sugars, which section has been brought up to date by Prof. A. R. LING. Altogether, this is an indispensable reference book for the analytical, research, and works' chemist.

Catalytic Processes in Applied Chemistry. T. P. Hilditch, D.Sc., F.I.C. (Chapman & Hall, Ltd., London.). 1929. Price: 16s.

Dr. HILDITCH'S book discusses catalytic processes in general, and there are besides useful chapters summarizing our present knowledge of the action of the enzymes in various fermentative processes. Enzymes have been termed "natural catalysts." Their action in bringing about various transformations, as the production of alcohol and certain acids from sugars, and the degradation of cellulose (as in the "Adco" process), constitute examples of catalysis at surfaces of colloidal organic

[1] *Chemical News*, 33, 7.

compounds. Enzyme action in such transformations is believed to be the sequence of : (1) diffusion of the enzyme through the solution ; (2) adsorption of the interacting surfaces on the surface of the enzyme particles, and (3) chemical interaction between the substances brought together on the surface. In hydrolytic actions as the conversion of sucrose to invert sugar, or of starch and cellulose into fermentable sugars, the acid used acts as a catalyst. It is noticeable in this book how important activated carbons are as catalysts in a number of industries, though this is an effect quite apart from decolorizing, in which the essential process is mainly adsorption of compounds of relatively high molecular weight at the surface or in the capillary interstices of the porous mass. Much useful information is here brought together, and is presented in an unusually readable way.

Anorganische und Organische Entfarbungsmittel. (Inorganic and Organic Decolorizing Materials). Dr. Leopold Singer. (Theodor Steinkopff, Dresden and Leipzig). 1929. Price : RM. 21.50 (bound).

Dr. L. Singer has taken on himself the task of summarizing the immense amount of literature which has now accumulated on decolorizing media of different kinds. He has collected the very great number of references to articles and patent specifications on this subject, giving in each case the name of the author, the gist of the communication in a few words, and in a footnote the name of the publication concerned. This is done for inorganic decolorizing media, such as the natural and artificial bleaching materials, as used in the oil industry, and also in considerable detail in the case of the carbonaceous bleaching agents, such as are intended to find application more particularly in the refining of sugar. The book should prove most useful for the consultation of the chemist who is investigating the possibilities of decolorizing carbons, and whose desire is to acquire a general knowledge of what has been done in this direction. One cannot but be impressed with the amount of industry which the author has expended on his work, which is certain to be well appreciated by all requiring to be fully acquainted with a development that promises much.

Hydro-Extractors : Their Safe Construction and Equipment. By a Committee of the International Labour Office of the League of Nations, Geneva. (P. S. King & Co., Ltd., Westminster, London, S.W.1.). 1929. Price : 4s.

Contents : General Remarks on and Classification of Hydro-extractors ; Dangers of Accidents in Working ; Calculations concerning Centrifugal Hydro-extractors ; Details of Construction ; Safety in Practice ; and Conclusions. Appendix : Some Accidents.

Four Years' Farming in East Anglia, 1923-1927. R. McG. Carslaw, M.A. University of Cambridge : Department of Agriculture, Farm Economics Branch, Report No. 12. (W. Heffer & Sons, Ltd., Cambridge). 1929. Price : 3s. (paper covers). 5s. (bound).

This report is on the same lines as previous publications by Mr. Carslaw, and some figures (which we will expand later) are given for sugar beet costs, these being summarized as £17. 3s. 6d. per acre or £2. 4s. 6d. per ton (assuming a yield of 7·71 tons per acre).

Annual Reports of the Society of Chemical Industry on the Progress of Applied Chemistry. 1928. Vol. XIII. (Society of Chemical Industry, Central House, London, E.C.2). 1929. Price : 7s. 6d.

Again we call attention to these valuable reports by different experts. Plant and Machinery is contributed by A. J. V. Underwood, M.Sc., A.M.I.Chem.E. ; Soils and Fertilizers by E. M. Crowther, of Rothamsted Experimental Station, Harpenden ; Sugars and Starches by Lewis Eynon and J. Hy. Lane ; Fermentation Industries by H. Lloyd Hind and F. E. Day ; and Foods by F. S. Aumonier and John King. As a record in brief of what has been accomplished in chemical technology during the past year these reports are excellent.

Brevities.

Dutch Beet Costs.—Figures are collected by G. van der Molen[1] regarding the cost of cultivation of beet in Dutch florins per hectare in respect of two factories in Holland, the figures including seed and transport being 408 and 432, an average of 420 Fl. per hectare, equivalent to £35 per hectare, or to about £14 per acre. In 1910 the figure was only 308·5 Fl.

Bending Glass.—In bending glass tubing of wide bore, there is difficulty in preventing the collapse of the wall. Ray N. Allen,[2] however, points out that if dry asbestos fibre be pressed tightly into the tube where the bend is to be made then the glass can be heated and bent without its collapsing, the soft glass being supported by the asbestos core, which later can be picked out with a wire.

Trade following the Flag.—" It pays us to buy our sugar supplies from the Empire. This sugar industry buys our machinery and supplies, whereas we get practically no orders whatever following our purchases of sugar from foreign sources . . . . I am very glad to see here to-day one of the sugar millers of Zululand who has just placed a large order for machinery in this country."—Extract from a speech by Sir Ben Morgan at a B.E.P.O. luncheon in London.

A New Sugar.—The U.S. Bureau of Standards reports the discovery in the laboratory of a new sugar, viz., di-fructose anhydride. By treatment with acid, inulin is converted to levulose, as is well known, and about 92 per cent. of the latter sugar can be thus obtained. A study of the remaining 8 per cent. however, revealed the presence of the new sugar, composed of two molecules of inulin combined in such close union that the acid under usual conditions does not hydrolyse it to levulose.

Sugar Bags.—At present sugar bags are generally purchased according to their weight, which is assumed to be directly proportional to their strength; but B Nowakowski shows that this is not necessarily so. Good bags should have a breaking strain of 65-78 kg. for the warp of a strip 20 cm. × 5 cm., and of 77-110 kg. for the woof of a similar piece; whereas these two sets of figures for poor bags may be 48-72 and 61-95. The strength of the seams should be determined similarly.

A.C. or D.C.—Q. A. D. Emmen[3] discusses the question of the current for use in the sugar industry in Java. General opinion is that A.C. should be used, except for driving the mills, for which purpose D.C. is preferable, as it enables the speed of the separate mills to be more easily regulated, besides causing less loss. This writer believes that only one variety of cane will in the near future be ground in Java, viz., POJ 2878, in which case it will not be necessary to give care to the regulation of the speed of the separate mills.

Molasses as Fertilizer.—W. W. G. Moir in a recent paper,[4] after reviewing the literature of the subject, urges that the question of the advantages of applying molasses to the soil amply proved in other countries, should be studied under Hawaiian conditions. The greatest effect must be on the micro-organic population of the soil and their resulting activity and changes in physical and chemical soil structure. Hawaiian soils have a very low nitrifying power, and also extremely low nitrogen availability, which latter is increased by molasses application.

Bagasse Utilization.—As a way of utilizing surplus bagasse, the United Fruit Co., at Preston, Cuba, are moulding it with blue clay (25 per cent.) into bricks 8 in. × 8 in. × 16 in., having a longitudinal hollow in the centre.[5] Before being used the blocks should dry for at least two weeks, after which time they form messes of dead-grass hue, weighing only 25 lbs., which are said to be suitable for any one-storey building, where great wall strength is not required. Such bricks are estimated to cost 6½ cents. each at present, though this would probably be less were large scale production adopted. They take grout readily and could be plastered smooth on the inside. There seems to be no reason why they should not be used on first-class building work, and they would appear to be more durable than adobe.

[1] *Tijdschrift*, 1928-29, 110-113. [2] *Philippine Journal of Science*, 1929, 38. No. 3, 299.
[3] *Archief*, 1928, 36, II, 648-652.
[4] *Presented at the 28th Annual Meeting, Hawaiian Sugar Planters' Association*, 1928.
[5] J. E. Murphy in *Unifruit Co.*, Feb., 1929.

JAMAICA PETITIONS FOR DUTY FREE SUGAR.—The Imperial Association of Jamaica lately passed a resolution requesting the Governor to petition the Labour Government at home to grant freedom from duty to imports of Empire sugar into Great Britain.

HEAT INSULATION.—1 sq. ft. of uncovered pipe surface carrying steam at 100 lb. per sq. in. will dissipate 850 B.T.U. per hour at ordinary atmospheric temperatures. In a year of 3000 working hours the steam wasted will amount to 2880 lbs., corresponding to a coal consumption of about 410 lb.

CENTRIFUGING SCUMS.—J. Bergé, progressive Belgian technologist advocates[1] the use of centrifugals dressed with cloth for the separation of the carbonatation scums obtaining thus a cake with 20 per cent. of water. Sugar losses can be reduced by this method, while working is generally cleaner and more expeditious.

SO_2 RECORDERS.—An electrical apparatus has been designed for the measurement of the percentage of sulphur dioxide in gases. A chart taken by means of this apparatus shows how the amount of SO_2 produced in a sulphur oven may rise and fall during a 24 hours' run, the variations, sometimes rather considerable, being accurately recorded.

SOAKING CANE.—J. A. Verret and A. J. Mangelsdorf[2] have repeated the experiments which were made in Porto Rico on soaking the cane seed in chemical solutions, viz. : those containing calcium and magnesium sulphates. In general, they confirm the favourable results previously obtained. Their best findings were with a 0·5 per cent. solution of iron sulphate, when the gains both in the percentage and the rate of germination were large compared with the control plots.

P.L.A. SUGAR SORTING.—A description of the methods used by the Port of London Authority in sorting sugar to quality was recently given by W. G. Hodgins.[3] All sorted sugars are bought and sold on the samples drawn at the time of sorting by the P.L.A., and it is a testimony to the care and skill exercised that serious complaints are so infrequent as to be non-existent. Quite large parcels of white Mauritius crystals varying slightly in colour are sorted in the same manner as low sugars.

CANE PLANTING.—Results obtained by the Victoria Milling Co., P.I., regarding the optimum distance between furrows for planting cane in that territory show[4] as the average of four crops the following figures : 3 ft., 116·29 piculs, 4 ft., 104·33 piculs, and 5 ft., 99·95 piculs. Hence, it would seem that the less the distance the better. Summarizing, the conditions that should be observed there are : system, simple planting ; distance between furrows, 3 ft. ; and distance between points in the furrows, 8 in.

RUTHS ACCUMULATOR.—The British Sugar Manufacturers, Limited, Wissington, have recently placed an order for a Ruths steam accumulator plant. Its overall dimensions will be 66 ft. 6 in. × 9 ft. 9 in., and it will have a capacity of 24,000 lbs. of steam when operating between the pressures of 225 lbs. and 50 lbs. per square inch. At Wissington, sugar refining will be carried out during the inter-campaign. It was concluded that during both periods the efficiency and general operating conditions of the factory could be greatly improved by this installation.

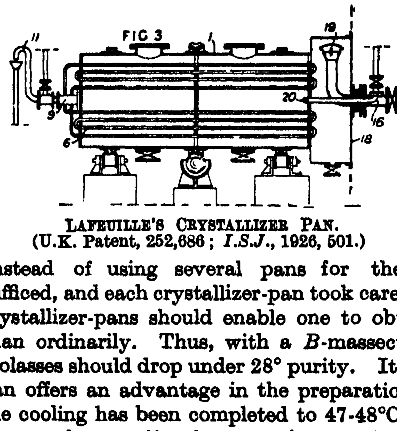
RÔLE OF THE CHEMIST.—"There was a time when a laboratory in a sugar factory was regarded as a superfluous luxury, and a chemist as a nearly useless workman. This idea has passed away for ever, and now it is realized that the great progress attained by the sugar industry during the last 50 years is due to investigations of several generations of educated chemists. The laboratory directs the work of the sugar-house, foresees the errors, investigates their reasons and shows the means of their removal, or the dangerous results if not removed. Such is the chemist's part, and the part of the laboratory in a modern sugar house."[5]

1 *Sucr. Belge*, 1928, 47, 444-445. 2 H.S.P.A., Experiment Station Committee Report.
3 *P.L.A. Monthly*, June, 1929. 4 CARLOS L. LOCSIN in *Sugar News*, 1929, 10, No. 5, 312-316.
5 Dr. JEAN KUCHARENKO, Director of the Sugar Experiment Station of the Ukraine, Kiev, Russia.

Review of Current Technical Literature.[1]

THE LAFEUILLE CRYSTALLIZER PAN. **F. Lafeuille.** *Sugar News*, 1929, **10**, No. 3, 210-218.

In the new Mount Arayat Central in the P.I. (600 tons a day) there have been installed two Lafeuille crystallizer-pans, each of 330 hectol. (1160 cub. ft.) which are stated to function with every satisfaction.[2] These are used in conjunction with an ordinary vertical vacuum pan of 175 hl. (600 cub. ft.), which is used only for the preparation of the *pieds-de-cuite*, one "Lafeuille" being used for *A*-massecuites using straight syrup and the other for *B*. For the *B*-massecuites graining is made in the vertical pan from concentrated straight syrup and the strike is built up with the same till it reaches about half height, about 80 hl. (280 cub. ft.). This *pied-de-cuite* is then transferred into the crystallizer, and the boiling continued by successive drinks of about 12-15 hl. (50 cub. ft.) each of *A*-molasses introduced sufficient to bring down the purity of the mass to about 64 (in reality the figures vary from 62 to 68). Concentration continues until a certain final Brix is attained, generally about 94 to 96. The duration of boiling of *B*-strikes in the crystallizer-pan is generally about 3 hours. There is no doubt that with better conditions of vacuum, steam and speed, this operation would be much shorter. Boiling being finished, cooling is begun, which has to be done slower than for the *A*-massecuites. It is difficult to give definite figures, but probably it can be done in from three to six hours.



LAFEUILLE'S CRYSTALLIZER PAN.
(U.K. Patent, 252,686; *I.S.J.*, 1926, 501.)

In regard to the results obtained, figures are given indicating that the crystallizer-pan enables one to obtain from *A*-massecuites drops of at least 30 points between the purity of the massecuite going to the centrigugals and that of the purged molasses. A 78° purity and 93° Brix, massecuite regularly gave a 48° purity *A*-molasses, the duration of the treatment in the crystallizer-pan being four hours. Instead of using several pans for the boiling of *B*-massecuites, one only sufficed, and each crystallizer-pan took care of three *B*-massecuites per day. Further, crystallizer-pans should enable one to obtain exhausted molasses lower in purity than ordinarily. Thus, with a *B*-massecuite at 60-62° purity and 98° Brix, the molasses should drop under 28° purity. It is important to note that the crystallizer-pan offers an advantage in the preparation of the massecuite before drying. After the cooling has been completed to 47-48°C. (117°F.), if the mass looks too thick to drop to the centrifugals, a certain quantity of diluted exhausted molasses or even of cold water may be introduced. After a few revolutions of the crystallizer, the liquid has been completely absorbed by the mass, without any washing out of sugar.

QUESTIONNAIRE ON SUGAR MACHINERY IN THE PHILIPPINE ISLANDS. **Theo. Nickelsen.** *Committee Reports for the Sixth Annual Convention of the Philippine Sugar Association*, 1928.

Mr. NICKELSEN, Chairman of the Committee on Manufacturing Machinery of the P.S.A., circulated amongst his friends a very complete questionnaire designed to cover the entire range of operations in the factory, the purpose being to elicit useful practical information from members of the Association on matters to which some have given special study. Mr. NICKELSEN himself returns some very interesting replies, our third summary of which is now continued[3] :—

Centrifugals.—*Q.* What make and size of centrifugals do you prefer? *A.* For handling from 1000 up to 2000 tons cane per day the 42 in. machine of standard manufacture has given good service. Solid spindle suspended machines with additional side-thrust ball-bearings supplementing the main supporting tiers of self-aligning balls and races, with conoidal rubber shock buffers, are the first choice of

2 See *I.S.J.*, 1926, 279; 1928, 397.
3 *I.S.J.*, 1929, 219, 276, 330.

many engineers. There are several excellent makes in the market to-day which give little trouble and excellent service. Batteries of eight or ten driven from a line shaft electrically operated are much in favour. For ease in operation, and reduction in maintenance costs, the water driven type, with centrifugal water pumps of adequate capacity supplying pressure at not less than 250 lbs. per square inch is preferred, and if the factory is totally electrified, the new direct electric drive. Belt drive has, in the past, given very efficient service and no doubt will find favour for some time to come; yet the water driven machine has not been developed to its maximum capacity; and where there is ample water supply this type should be more in favour. *Q*. Do you believe the slotted screens are the most efficient ? *A*. Yes. They also have a longer life. *Q*. What speeds do you advocate for highest efficiency in carrying the machine to overload ? *A*. A slower speed with an extended time limit will give higher results in handling viscous low grade massecuites than higher speeds. Increasing the speed of the machine proportionately increases its capacity when handling free drying high grade raw sugars. Up from 1200 to 1800 r.p.m. will decrease the time necessary to drying a basket from 3½ mins. down to 2½ mins. It is not advisable to run under maximum high speeds unless care is taken in training the operators and the centrifugals are in first class order. *Q*. What class of lubricant would you suggest most suitable for operation of this equipment ? *A*. A high class yellow lubrication grease packed by special type of grease cups or guns will fill all requirements, although a high speed light mineral oil of the class used on dynamos and motors can be used quite successfully. It will be found that this oil might be graded a little higher in density for centrifugal work than when used in motors or generators. Ordinary engine oil has proved successful on the back shafts. *Crystallizers.*—*Q*. Are the drives of modern crystallizers designed correctly in relation to the necessary speeds ? *A*. The worm and worm wheel drive for crystallizers may be replaced by a more adequate and efficient drive. *Q*. Do you believe that the worm drive is the best to operate the stirrers ? *A*. Cut gears, herring-bone type, direct connected to a line shaft, operated by individual pinions with efficient clutches, or all independent motor drives through reduction gears. *Filter-Presses.*—*Q*. Are the plate-frame types of filter-press your idea of the ultimate in the operation of this part of your factory ? *A*. The frame types of filter-press under efficient operation and supervision and erected with a view to suit local conditions are giving good results in many of our factories in the Philippines. The filter-press station is one involving more labour, with uncongenial and distasteful work, than any other part of the factory, and it is found that wherever the work is hard, dirty and undesirable it is there that the costs of operation are highest. To cut down costs at this station somewhat under present operating conditions, the following improvements to those whose factories are not already so equipped may be suggested. That the present solid cast-iron frame be substituted with one of brass construction. That the setting up of the screws be powered hydraulically. That the washing of the filter-press cloths be accomplished by large, modern rotary washers and centrifugal dryers, of easy operation and handling. That high pressure hot water be available, with good hoses and nozzles, for washing down the presses after the mud has been discharged. A continuous filter such as is used in extracting the potash, etc., from some lakes of Southern California is now being developed for sugar-house work. If these prove acceptable for filtering the mud continuously, our costs and losses may both see a reduction at this station.

Settling Tanks.—*Q*. Considering floor space, heat losses, number of men employed and supervision necessary, do you believe the present type of open tank type settlers are to be desired to take care of the juice defecation and clarifying in our modern factories ? *A*. Considering first cost, floor space, insulation, close supervision necessary in conjunction with open tanks and that we have in the market to-day various classes of reliable continuous juice settlers, these latter are more to be desired and are fully adequate to the work of clarification in the factory. *Heaters and Pumps.*—*Q*. What class of juice pumps would you advocate to show an all round usefulness and with least necessary expense in upkeep ? *A*. Centrifugal pumps of compact design are entirely adequate for the highest pressures and capacities required to meet

all requirements at this station. *Q*. Do you prefer the horizontal or the vertical heater and why? *A*. Vertical heaters are the more easily cleaned if installed with proper forethought for flexibility and low cost operation. The steam heating efficiency of the vertical heater compares equally and favourably with the horizontal type. *Q*. What are your ideas of size in connexion with working up juices from 180°F to 220°.F. at normal Brix measured at so many gallons to the square foot of H. S. per hour? *A*. Results obtained in gallons of juice heated per square foot per hour vary greatly in different factories and under different conditions. There are cases where a factory design allows 5 gallons of juice per square foot per hour and recent results indicate efficiencies as high as 20 gallons per square foot per hour. An allowance of 5 to 7 gallons juice per square foot per hour for heater work, under all conditions, would be a conservative base. *Evaporators*.—*Q*. In your opinion is the standard submerged tube type the best on the market for the sugar factory of to-day? *A*. There are no other evaporators that have all the advantages of these, made at as low a price in the environs of the American sugar industry for our use to-day. Other types generally either (*a*) are higher in price, (*b*) take up larger floor areas, (*c*) are more difficult to clean, or, lastly (*d*) demand auxiliary power for circulation of the juices. *Q*. What length of tube would you prefer? *A*. For tubes of evaporators having 5 to 15,000 sq. ft. of heating surface in quadruple effect one recommends 3 ft. 6 in. as the maximum length. For evaporators having over 15,000 sq. ft., but not more than 25,000 sq. ft. of heating surface, one can recommend that the length of the tubes be made 4 ft. *Q*. What thickness of tube and tube sheet? *A*. In deciding the thickness of the tube sheet one might be inclined to take into consideration the imperfection of mechanical details in operation and repairs and would demand more than the conventional $\frac{3}{8}$ in. + thickness for the 11, 12, 13, 14, and 15 ft. diam. calandrias. A $\frac{1}{2}$ in. to $\frac{5}{8}$ in. tube-sheet for the larger diameters would insure against undue distortion and buckling of plates in erection and would also not be so liable to enlargement of the holes through re-rolling during repairs, after some time in operation. *A*. The copper tubes of $\frac{3}{32}$ in. to $\frac{5}{32}$ in. thickness corresponding to American gauges Nos. 13 and 9 have given efficient service and stand up well under the conditions obtaining in the factory. *Q*. What height of vapour space above the tubes? *A*. Measuring from the surface of the calandria upper tube sheet to the lower flange of the dome in the vapour space of the first three cells in a quadruple effect, the distance should not be less than 8 ft.; and 9 ft. 6 in. is advocated for the fourth cell. *Q*. What are your ideas of size limitation? *A*. Owing to natural increase of static head in conjunction with longer tubes used in the larger sizes of evaporator one hesitates in recommending these in sizes above 30,000 sq. ft. for quadruple effect evaporators, but would duplicate units (for one factory) in 20 to 25,000 sq. ft. heating surface, sizes. This statement does not confine us to a hard and fast rule as there are conditions wherein the installation and operation of 40,000 square-foot quadruple effect evaporators are not only desirable, but are more economical and highly efficient. As mentioned in a former paper, these empirical rules cannot be advanced without considering local conditions, class of machinery, personnel, and methods of operation. *Q*. Would you advocate save-alls, and if so, would you prefer these to be placed in the vapour lines or at the top of the vapour bodies? *A*. Save-alls, together with ample space in height from the calandria tube sheets to domes as outlined above, would be preferred in the vapour lines. One also advocates the installation of a good design of save-all between each effect, and one of special size for the vapours of the fourth cell. The areas for the passage of vapours, especially where they are made to cause an entire reversal in flow direction, should be made 5 per cent. to 10 per cent. greater than figures of theory demand. It has been found by experience that many of these save-alls in their operation of eliminating entrainment, seriously obstruct the free passage of the vapours and greatly reduce the natural capacity of the evaporator. *Q*. What method of week-end cleaning do you employ? And please give your ideas of any betterment you may believe could be made to cut down time and expense. Have you ever had any trouble with your evaporators? If so, would you describe your remedies in overcoming these. *A*. Week-end cleaning of evaporator heating surfaces

by boiling out with strong solutions of caustic soda followed by hydrochloric acid and then boiling freely with hot water, and this again followed by a gang of men with scrapers, was, and is, the usual week-end procedure in most of our factories here in the P.I. However, we have now a new method, which has found much favour in Hawaii, as also in one or two factories in the Philippines. One of our largest factories reports that throughout the whole of the milling season of the year 1927-28 the doors of the evaporators were never opened for hand cleaning, and only once or twice for inspection purposes. This new method includes a two-hour boiling in each effect with strong solution of beer, i.e., fermented molasses or leas from the distillery. This is preceded by injection, through a 2 in. Yarway nozzle for an hour or so of a strong solution of caustic soda, a 50 to 60° Brix solution, which is again followed by boiling with a solution of hydrochloric acid and hot water to wash out thoroughly the sediments remaining. This method is efficient and economical and has the added advantage that in a few hours three or four evaporators in the same factory can be cleaned by one attendant. A 2 in. or 3 in. Yarway nozzle, placed in an inverted position over the centre of the calandria at suitable height operating with 100 lbs. pressure, causing a spray-fog that insures the soda solution reaching to every part of the calandria, should be effective, with other provisions enumerated above, in keeping the apparatus free from scale and dirt without trouble. This pressure of not less that 60 to 100 lbs. should be maintained or else the caustic solution will not become effective in entirely saturating all parts of the calandria and tubes.

REFINED SUGAR MANUFACTURE DIRECT FROM CANE JUICE, USING "DARCO." **C. F. Dahlberg.** *Facts about Sugar*, 1929, **24**, No. 23, 544-545. Juice from the mills goes through the usual Louisiana treatment applied in the manufacture of plantation whites. Charge to the *A*-pans consists of one-third of "Darco" liquor of high purity, one-third of syrup of 80° and one-third of refined of 85° purity, the massecuites obtained giving refined sugar. The run-off from this massecuite, the wash from the second sugar, the drainings from the brush pan, and other low-grade syrups are boiled in the *B*-pan to second sugar, which is re-melted and treated with 0·5 per cent. of "Darco" of the weight of solids. This forms the "Darco" liquor for the *A*-pan mentioned above. White sugar made by this process is said to be the equal of bonechar-refined.—BOILING LOW GRADE SUGAR. **Victorino M. Kilayko.** *Sugar News*, 1929, **10**, No. 5, 324. Molasses, 56-58° purity, is diluted to about 75° Brix, steamed to dissolve its grain, and concentrated in a calandria pan to super-saturation, at which point the steam supply is shut off, and the condenser injection water increased. As the temperature decreases, minute grains separate. Hot water is injected to reduce the viscosity around the crystals, after which a continuous charge of diluted molasses is begun, being continued till the pan is filled up. The resulting massecuite is "cut" to a seed tank, leaving in the pan enough on which to build another strike. After the second strike, another "cutting" may be necessary to increase size of grains, or to keep massecuite down to a desired purity. A massecuite is dropped to a crystallizer, being concentrated to 95-96° Brix, and cooled to about 150°F. A massecuite boiled as described need not stay in a crystallizer longer than four days for it to turn out molasses of not higher than 35° gravity purity. Its grains should be hard, and uniform.—PHOSPHORIC ACID DETERMINATION IN SOILS, USING THE MOLYBDATE BLUE METHOD. **O. Arrhenius.** *Archief*, 1927, **35**, II, No. 36, 903-911. 10 c.c. of the 2 per cent. citric acid extract of the soil are placed in a 100 c.c. flask, diluted to about 80 c.c., and the following are added: 1 c.c. of concentrated sulphuric acid, 5 c.c. of ammonium molybdate solution (25 grms. in 300 c.c. of water plus 200 c.c. of dilute sulphuric acid, made by diluting 75 c.c. of the concentrated acid to 200 c.c.), 1 c.c. sodium sulphite solution (20 grms. plus 80 c.c. of water) and 1 c.c. hydroquinone (0·5 grm. per 100 c.c. plus one drop of concentrated sulphuric acid). Then the flask is completed to the mark with water, mixed, and after 12-24 hours the colour is compared with a standard series of solutions of known P_2O_5 content varying from 0·03 to 0·90 mgrm. P_2O_5 per 100 c.c. This method is sensitive, and accurate. With the aid of three native assistants, it is possible for the analyst to make 300 determinations in a day.—KIESELGUHR

("HYFLO SUPERCEL" AND "SUPERCEL") FOR THE FILTRATION OF BEET PRODUCTS. **A. Elsenbast and K. Dern.** *Facts about Sugar*, 1929, **24**, No. 21, 494-496. Filtering thick-juice, melted sugar, wash and greens, requires from 0·2 to 0·8 lbs. "Hyflo" per ton of beets sliced, or from 0·07 to 0·27 lbs. of "Super-cel" per 100 lb. bag of finished sugar. A factory slicing 1000 tons of beets per day would use about one sack of "Hyflo" per day, representing a negligible cost when compared with the savings in mechanical operation outlined above.—TESTS WITH THE SHARPLES "SUPER-CENTRIFUGE" IN JAVA. **J. Jongsma.** *Archief.*, 1929, **37**, I, No. 9, 289-300. This machine (Type C II) having a speed of 16,000 revs. per min., and a capacity of 600 litres per hour, was applied to the clarification of syrups produced in the double-curing battery. Figures are given of a test which lasted 2¼ hours, the grms. of scum separated per kg. of product being 0·89 grm. No particularly satisfactory result appears to have been obtained, and it is remarked that the sugar industry has more to expect in the direction of a larger, somewhat less rapidly revolving machine having a larger scum chamber.—PATENTS ON CONTINUOUS CENTRIFUGALS. **J. J. W. den Haan.** *Archief.*, 1929, **37**, I, No. 19, 500-516. This gives a useful review (with drawings) of such apparatus, the particular specifications discussed being: German Patent, 420,683, by W. C. Roos; U. S. Patent, 1,422,393, by A. C. SNYERS; U. S. Patent, 1,630,201, by V. E. MITCHELL; Dutch Patent, 32,712, by V. A. FESCA & SOHN; German Patent, 450,899, by M. L. SANSARICZ; and German Patent, 461,743, by VICTOR REDLICH. It is remarked that the design of a continuously operating centrifugal is a troublesome problem, especially in the case of such a product as sugar massecuite. None of the six patents reviewed warrant great expectations. Only the FESCA invention, which is continuous only in a restricted sense, is likely at all to survive.—SIMONSEN'S OIL FOR DENATURING ALCOHOL. *Communicated by the Manufacturers.* Some information has already been published on this important method of rendering alcohol unfit for drinking,[1] and the following additional data are now given: Simonsen's oil which may be either water-white or yellow in colour should have a sp. gr. between 0·775 and 0·795 at 15·5°C. When subjected to distillation, it should not yield more than 5 per cent. of fraction boiling below 100°C., not more than 30 to 50 below 150°C., and not less than 90 per cent. boiling below 250°C. On distilling alcohol which has been thus denatured, all the oil passes over into the distillate. Nor can the denaturant be removed by dilution with water, since then an inseparable emulsion is formed, the unpleasant smell and taste of the product being moreover increased. It is impossible to drink spirit which has been treated with Simonsen's oil, the effect of which is to paralyse the muscles of the throat. It forms therefore an infallible denaturant. On the average the quantity used is 1 per cent. Its cost is about 2s. 6d. per Imperial gallon.—JAVA FACTORY RETURNS FOR 1928. **G. Booberg.** *Archief, Mededeelingen*, 1929, No. 1. Cane harvested in quintals per hectare in 1928 was highest at 1750 and lowest at 960; whilst yields varied from 14 to 8·18 on the same basis. This year 51 per cent. of the factories turned out 160 quintals of sugar per hectare, whereas in 1927 only 16 or 9 per cent. reached this figure. Eight factories produced 200 to 230 quintals per hectare, a figure showing great improvement.—APPLICATIONS OF THE CONDUCTIVITY APPARATUS. **K. Sandera.** *Zeitsch. Zuckerind. Czecho-slov.*, 1929, **53**, No. 30, 378-382. A list of the many uses to which the apparatus used for the determination of ash in sugar solutions by their conductivity is given, some general applications being: the elucidation of saturation problems; determination of the adsorption of electrolytes by filter-cloths; indication of the end-point in saturation (carbonatation) and of the mineral matter in filter-press wash-waters, slice waste-waters; and for the characterization of decolorizing carbons. In factory work the "Conductometer" may be applied for ascertaining the salt content of the raw juice and of water used for diffusion, especially when the waste-waters are treated and returned to the battery. Conductivity determination should be applied throughout the factory or refinery process as they instantaneously indicate any irregularity.

J. P. O.

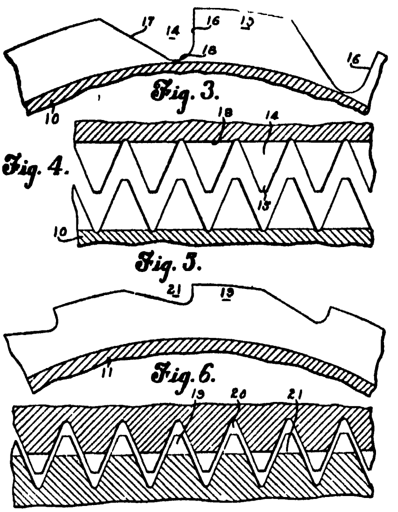
1 See also *I.S.J.*, 1919, 519; 1920, 585; 1921, 268, 326, for references to SIMONSEN'S oil.

Review of Recent Patents.[1]

UNITED STATES.

Crusher Grooves. **Franklin Farrel, Jr.** (assignor to the **Farrel-Birmingham Co.**, of Ansonia, Conn., U.S.A.). 1,696,945. January 1st, 1929. (Filed June 28th, 1924; serial, No. 723,015.)

A pair of preliminary crushing rolls is shown, followed by a second pair, delivering the crushed cane to a juice-expressing mill. The rolls of the crushers are provided with teeth for drawing in the cane so that the latter will be fed in a uniform and expeditious manner. The rolls are provided with a plurality of circumferential V-shaped grooves, which provides correspondingly shaped ridges or ribs, and the ribs of one roll of the pair enter the grooves of the other roll with a certain amount of clearance as shown in Fig. 4. The circumferential grooves are intersected by generally longitudinal grooves 14, the result of which intersection is the formation of the teeth 15, as shown in Figs. 3 and 4. Each of the longitudinal grooves 14 has an abrupt side 16, a sloping side 17, and a rounded bottom 18, as shown in Fig. 3. While the grooves 14 are longitudinal in a general sense, they are preferably not exactly parallel to the axis of the roll; in in fact, it is considered the best practice to provide an obtuse angle in the lengthwise groove. In the second crusher, the grooving in its general features is similar. Teeth 19 (Fig. 6) are formed by the provision of circumferential grooves 20 and longitudinal grooves 21. It will be noted, however, that whereas in the case of the last crusher, the longitudinal and circumferential grooves are of substantially the same depth, the longitudinal grooves 21 of the second crusher are of substantially less depth than the circumferential grooves 20 thereof. In the first crusher, the circumferential grooves are, say, $\frac{1}{32}$ of an inch deeper than the longitudinal grooves in order to insure the scraper points of usual construction (not shown) reaching fully to the bottoms of the longitudinal grooves and thereby cleaning the same out thoroughly. In the second crusher, however, where less drawing effect is necessary the longitudinal grooves 21 are only approximately one-third as deep as the circumferential grooves 20. In any case, the longitudinal grooves are substantially shallower than the circumferential grooves in the second crusher. This increases the shredding action and the juice expressing effect. Cane stalks supported in the shallow lengthwise grooves 21 at a plurality of spaced points are carried by a sort of wiping motion down into relatively deep valleys of the second pair of crusher rolls by the circumferential ribs of said rolls. This wiping motion shreds the stalks to a considerable degree and tears the same apart, and the squeezing of the stalks in the valleys is also considerable. It will be observed that the longitudinal grooves 21 of the second pair of crusher rolls 11 are spaced at a less distance from each other than are the longitudinal grooves 14 of the first pair of crusher rolls. Thus there is a tendency in this particular case to compensate for the relative shallowness of the grooves 21 by increasing the number thereof as compared with the longitudinal grooves of the first rolls. Nevertheless, in spite of the fact that the grooves 21



[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin Germany.

are of greater number and closer together than are the grooves 14, the pitch of the circumferential ribs of the second crusher rolls is the same as that of the circumferential ribs of the first pair. It will be unnecessary in all aspects of the invention to provide the second pair of crusher rolls with shallow longitudinal grooves and relatively deep circumferential grooves. Various changes in this and other respects may be made without departing from the scope of the invention as defined by the claims.

CRUSHER AND MILL ROLLER GROOVES. **David Milne** (assignor to the **Farrel-Birmingham Co.**, of Ansonia, Conn., U.S.A.). 1,700,571. January 29th, 1929. (Filed September 14th, 1925; serial, No. 56,300.)

Rolls are provided with a number of pits 18 in the form of recesses formed in the walls of the grooves and ridges. While these recesses may be varied considerably in form, they are according to the preferred embodiment (Fig. 4) of substantially hour-glass shape, having enlarged or flaring end portions 19 and 20, and restricted intermediate portions 21. The pits are elongated in shape and extend substantially over the entire wall 22 of the groove and especially to the apex 23 of the ridges, as shown in Fig. 2, the upper end of these pits intersecting the ridges, the result being that the ridge presents a sinuous or wavy outline. While, as stated, these pits extend substantially over the greater part of the wall of the groove, they may terminate a short distance from the bottom thereof, as shown in Fig. 4. These pits are formed substantially radially of the axis of the roll, and while the two corresponding pits on the opposed walls of each groove are set substantially opposite each other, they are preferably staggered with the pits of the adjacent grooves so that the pits upon one side of each of the ridges are staggered with those formed on the other side thereof. The pits are preferably formed in the surface of the rolls by a mechanical process so that they may be made with a degree of evenness and regularity and may be staggered on opposite sides of the ridges, as explained, although it will be understood that the location of these pits may be varied as well as their shape or number, without departing from the principle of the invention. The pits will not interfere in any way with the operation of the roll scrapers, so that the result is that with rolls embodying this invention there is a positive feed of the cane thereto without appreciable slippage, and a mill may be used to capacity immediately that a new roll is installed, thus representing a great saving over the prior practice when the operation of the mill was required for a week or more with the rolls opened up before they could be closed down, and operated at capacity load. As shown in Fig. 3, when the pits upon one side of a ridge intersect the ridge line or apex at one side thereof, and are staggered with the pits intersecting the ridge line upon the opposite side, this line or apex presents a wavy appearance and will itself be roughened to some extent so as to increase the drawing action of the rolls upon the cane. Briefly, the mechanical process for forming the pits will be that of rolling or knurling depressions in the roll surface. The pits or depressions will be created by forcing in or denting the metal of the roll surface at points in regular succession, so that the elongated depressions are equidistantly arranged around the circumference of the roll, preferably in a multiplicity of annular series, these annular series being staggered, as before described, although this is not always necessary. The bottoms of the pits or depressions are curved by preference, and, preferably also, the pits are rather shallow and yet fairly wide, as shown in Fig. 3.

Fig. 2.

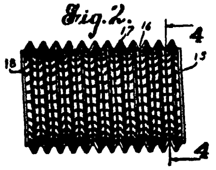


Fig. 4.

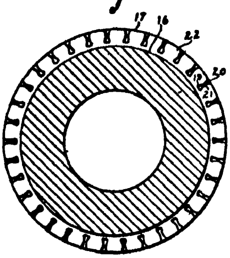
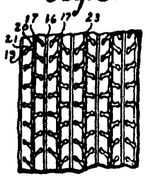


Fig. 3.



Improvements in Building Boarding Manufacture (e.g., from Bagasse). **Arthur E. Millington,** of Chicago, Ill., U.S.A. 1,708,586. April 9th, 1929. In a process of utilizing waste wood products in the manufacture of building boards wherein the same consists in first disintegrating the material, then softening the same with a solution of salt and soda ash along with water and steam under pressure, then refining the mass, and finally forming the mass into boards.—Dextrose Production. **Raymond E. Daly** (assignor to **American Maize-Products Co.,** of Roby, Ind., U.S.A.). 1,708,940. April 16th, 1929. A process of producing crystallized dextrose from sugar liquor derived from converted starch consists in bringing the sugar liquor to a density of about 37 to 42° Bé., reducing the temperature to substantially 120° F., adding dried seed crystals, reducing the temperature to about 100° F., introducing the liquor into a crystallizer containing wet seed crystals in amount equal to substantially one-half of the introduced liquor, slowly agitating, reducing the temperature to about 90 to 95° F., maintaining the liquor at this temperature until the mass is permeated with crystals, raising the temperature to about 110 to 120°F. to cause the finer crystals to go into solution, slowly cooling the magma to about 90 to 95°F. to cause the unmelted crystals to develop into relatively large crystals, maintaining the magma at this temperature for about twelve hours while slowly agitating, and centrifuging to separate the crystals from the mother liquor.—Density Measuring Apparatus. **Chas. W. Foulk** (assignor to the **Kauffman & Lattimer Co.,** of Columbus, Ohio, U.S.A.). 1,709,258. April 16th, 1929. In an apparatus for measuring the density of liquids, the combination of a calibrated tubular member, a submerged member lighter than the liquid in which it is to function surrounded by said member vertically movable within the space defined by said member, and a chain connecting the said submerged member to said member, one end of said chain being supported by the bottom portion of said submerged member and the other end being supported by said member, the said connecting chain forming a catenary curve.—Alcohol from Burnt Green Cane. **Joaquin Julio de la Roza, Sr.** (assignor to the **Bagasse Products Corporation,** of New York, U.S.A.). 1,709,610. April 16th, 1929. A method of producing alcohol comprises extracting the liquid content from burnt green sugar cane which has been submitted to ordinary atmospheric conditions existing in cane growing localities until an inversion of sugar content has occurred, fermenting and distilling the extracted content.—Extracting Filter-Cake. **Hugh H. Cannon,** of Los Angeles, Cal., U.S.A. 1,710,343. April 23rd, 1929. A method of extracting entrained matter from filter-cakes comprises : passing through said cake a solvent for the entrained matter, and introducing with said solvent a finely pulverized insoluble material in quantity sufficient to fill shrinkage cracks formed in said cake by the withdrawal of said entrained matter by said solvent.—Cane Harvester. **Harry F. Duncan,** of Ewa, T.H., 1,710,611. April 23rd, 1929. A harvester combines a series of cutters for severing the stalks near the surface of the ground, a conveyor for receiving stalks from the cutters, a plurality of rollers and brushes to which the stalks are conveyed, a swinging saw and means for moving the saw in an arc-shaped path parallel with the axes of the rollers, for cutting stalks discharged by the rollers, a conveyor receiving material from the saw, and means for separating tops from the stalks while passing over this conveyor.—Beet Harvesting Machine. **Caleb S. Coatsworth,** of Chatham, Ont., Canada. 1,711,990. May 7th, 1929. A beet harvesting machine adapted for pulling and topping beet roots, comprises in combination a wheeled vehicle having a rigid supporting frame mounted thereon, an interior adjustable frame hinged to the end of said supporting frame, a double cone beet plough attached to the lower side of said adjustable frame and preceded by double inthrow cutting discs, a double disc casting wheel rotatably mounted across the adjustable frame and actuated by the drive wheels of the vehicle, a series of pairs of clamp arms radially mounted around the perimeters of the double disc casting wheel, one arm of each pair being attached to each disc and pivoted thereto near the centre of the arms, adjustable beet clamps pivotally attached to the outer ends of all the clamp arms, a series of interior operating pins slidably mounted in each of the disc walls of the double disc casting, said pins engaging the inner ends of the clamp arms, a compression coil spring mounted on

each of the said operating pins for forcing the pin and arms outward for closing the attached beet clamps together, semi-circular operating cams fixedly attached to the sides of the adjustable frame, said cams being positioned to engage the inner ends of the clamp arms during the downward portion of its rotation for holding said clamp arms open, an interior topping knife fixedly interposed between the outer ends of the pairs of clamp arms near the top of the wheel and means for conveying the severed beet tops from the wheel.—YEAST FOOD. **Oscar R. Brown,** of Denver, Ind. 1,712,025. May 7th, 1929. This comprises potassium nitrate, calcium phosphate, and magnesium sulphate.—CANE HARVESTER. **Cecil A. Ventress.** 1,712,913. May 14th, 1929. A cane harvester, having horizontally adjustable stalk cutting means, combines a horizontal conveyor for receiving the stalks from the cutting means, a rotary top cutting device mounted in a vertical plane, a finger projecting over the conveyor, adjacent to the top cutting device for engaging the stalks while being topped, an elevating conveyor for moving material from the conveyor first named, a third conveyor receiving material from the elevating conveyor, stripping means mounted alongside the third conveyor, and means for disposing of material received from the stripping means.—REDUCTION OF SUGARS TO ALCOHOLS. **Henry J. Creighton** (assignor to the **Atlas Powder Co.,** of Wilmington, Del., U.S.A.). 1,712,952. May 14th, 1929. Sugar reducing apparatus comprises an electrolysis cell, a reduction cell, means for discharging an amalgamation formed in the first named cell into the last named cell, an agitating means directly engaging the amalgam in the last named cell, a mercury reservoir, means for discharging mercury from the reduction cell into said reservoir and means for discharging mercury from the reservoir into the electrolysis cell, the discharging means for the electrolysis and reduction cell being so formed as to maintain a given amount of mercury in each of said cells.

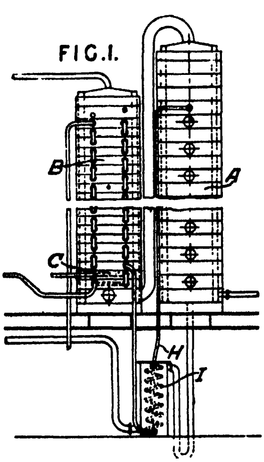
UNITED KINGDOM

PRODUCTION, REVIVIFICATION, AND ACTIVATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **C. J. G. Aarts,** of Voorburg, Holland. 308,351. March 14th, 1929; convention date, March 22nd, 1928. (*B*) **N. V. Norit-Vereenig-ing Verkoop Centrale,** of Amsterdam, Holland. 309,855. July 25th, 1928; convention date, April 16th.

(*A*) A product consisting chiefly of carbon and containing also iron and iron oxide is obtained by passing carbon monoxide over heated finely divided iron oxide under such conditions that the reaction $2CO = C + CO_2$ takes place and the iron is alternately oxidized and reduced and serves as an oxygen carrier in the reaction. The product is valuable as an absorbent, for decolorizing liquids, as a pigment, and for making electric furnace electrodes. (*B*) Active or decolorizing carbon, the activity or decolorizing power of which can be varied for the purpose in view, is obtained by impregnating charcoal, brown coal or anthracite in granular or other fragmentary form with activating, oxidizing, purifying, extracting, etc., chemicals, and then subjecting it to a burning operation. The charcoal may be prepared from coconut or other fruit shells or kernels, hard woods or peat. The chemicals used include phosphoric, nitric, sulphuric and hydrochloric acids and their salts and carbonates, hydroxides and sulphides. Salts of the alkali, alkaline earth, or heavy metals or of ammonium may be employed, including iron, zinc or aluminium salts. After the burning operation an extraction and washing may be provided to remove the non-volatile chemicals. The materials may also be extracted, e.g. with hydrochloric acid, and washed with water prior to the impregnation. Gas-activation, e.g. by steam, may also be employed prior or subsequent to the activation according to the present process. Increased hardness may be obtained by impregnation with hardening agents. The raw materials may be ground and agglomerated by means of organic or inorganic binding agents or mixtures thereof before the activating treatment, and the hardness and density may be varied by controlling the grinding and the pressure employed in agglomeration and by the selection of the binders. The agglomerates may be made from gas-activated carbon or gas-activation may be applied thereto prior to the impregnation or subsequent to the burning operation.

IMPROVEMENTS IN THE ART OF MOLASSES DESACCHARIFICATION. **J. Bergé**, of Tirlemont, Belgium. 308,867. February 14th, 1928. Syrup or molasses is de-sugared by distributing it in a thin layer over pure sugar crystals so that the crystals are surrounded, for example, by a uniform coating of 15 per cent of syrup. The surface of crystallization is thereby enlarged and the thickness of the syrup layer around the crystals is reduced. By suitably controlling the conditions of storage of the crystals, such as temperature and humidity, the effect of de-saccharization of the syrup may be intensified. Pure sugar crystals may be added directly to massecuite to convert the latter entirely into raw sugar; or the crystals may be added only in such quantity that the mixture can be mashed and centrifuged, the syrup removed being mixed with excess of crystals as in the first method. Syrup may also be added in larger quantity to pure sugar crystals, and the excess then removed so as to produce the requisite thin coating; the syrup thus separated may be mixed with a fresh batch of crystals. Syrup which has already been centrifuged may be sprayed upon sugar crystals in mass. When the syrup or molasses coating the crystals has been sufficiently de-sugared, it may be separated from the sugar crystals by centrifuges of correspondingly higher centrifugal force, the crystals being utilized again for de-sugaring. (Specifications 3782/94 and 225,221 are referred to).—PRESERVATION OF SACCHARINE VEGETABLE MATERIALS. **Schering-Kahlbaum A.-G.**, of Berlin. 309,195. April 6th, 1929; convention date, April 7th, 1928. Polysaccharides in vegetable material such as sugar beet, chicory roots, Jerusalem artichoke tubers, are stabilized and preserved to render possible a recovery and working up of the sugar material at any desired time by treating the starting material in the form of a paste with an agent which prevents fermentation without being narcotic. Such agents include carbon monoxide, hydrogen cyanide, and fluorine compounds. Thus, for example, into the paste carbon monoxide preferably under slight excess pressure, or hydrogen cyanide is passed, or a cyanogen salt such as potassium cyanide may be added to the paste to give a concentration of 0·01 per cent. of hydrogen cyanide under the action of the acid cell juice. Sodium fluoride in a concentration of 0·1 per cent. may be used.—STILLS OF THE COFFEY TYPE. **J. McDougall**, of Glasgow. 309,317. April 18th, 1928. In distilling apparatus of the Coffey type, the vapour coming from the analyser *A* is cooled either before it enters the rectifier *B*, e.g. by passage through water-cooled coils or through a tubular condenser or while in the rectifier by means of cooling-coils *C* in which a current of water flows. In addition the wash after leaving the rectifier *B* may be heated in a heater *I* at least to its boiling point before passing to the analyser *A* through a pipe *H*.—HYDROCHLORIC ACID REMOVAL IN CELLULOSE SACCHARIFICATION PROCESS. **A. Classen**, of Aachen, Germany. 309,896. January 17th, 1929. Hydrochloric acid, particularly in residual traces, is removed from sugar solutions such as are obtained by the saccharification of cellulose-containing substances by hydrochloric acid, by distillation preferably under reduced pressure in the presence of grains or pieces of quartz, or substances capable of yielding silicic acid such as naturally occurring silicas, e.g., natural opal.—CRYSTALLIZING SUGAR. **Baratier Corporation**[1] (assignees of **C. A. Spreckels**). 310,369. March 22nd, 1929; convention date, April 24th, 1928. Large symmetrical sugar crystals are obtained by blowing air or other gas through sugar liquor, thereby causing vigorous agitation of the liquor and evaporation of water. Crystallization may be aided by the addition of small sugar particles. Fresh sugar liquor is added as the crystals grow. The temperature is kept below the caramelization point.

FIG. 1.



1 See also U.K. Patent 308,606, *I.S.J.*, 1929, 341 (which should also have been in the name of the Baratier Corporation).

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending June 30th.		Six Months ending June 30th	
Unrefined Sugars.	1928. Tons.	1929. Tons.	1928. Tons.	1929. Tons.
Poland	549	....	549	37,976
Germany	....	4,080	....	27,570
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	8,785	4,807	9,033	16,986
Java	....	....	3,244	78,876
Philippine Islands	....	....	....	....
Cuba	48,831	69,545	323,584	270,173
Dutch Guiana	....	....	....	....
Hayti and San Domingo	48,656	30,720	169,735	134,427
Mexico	....	....	....	....
Peru	3,884	2,464	44,045	65,150
Brazil	1,076	298	11,969	11,185
Union of South Africa	....	....	11,933	16,394
Mauritius	4,632	3,953	123,914	174,100
Australia	1,989	....	68,365	96,010
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	25,669	25,230	73,267	61,270
Other Countries	4,376	1,196	37,260	23,112
Total Raw Sugars	**148,445**	**142,294**	**876,900**	**1,013,229**
Refined Sugars.				
Poland	695	....	3,136	....
Germany	....	346	874	525
Netherlands	4,732	1,003	67,506	8,910
Belgium	237	135	2,863	682
France	....	....	....	....
Czecho-Slovakia	7,974	2,790	77,003	13,915
Java	....	....	....	....
United States of America	1,452	972	10,233	4,479
Canada	3,996	1	5,033	7
Other Countries	36	40	2,969	69
Total Refined Sugars	**19,123**	**5,286**	**169,616**	**28,588**
Molasses	16,944	26,397	119,182	134,821
Total Imports	**184,512**	**163,977**	**1,165,698**	**1,176,638**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	122	111	581	595
Netherlands	48	9	200	159
Irish Free State	3,221	3,865	23,695	24,202
Channel Islands	85	71	861	524
Canada	....	....	....	....
Other Countries	546	1,889	6,561	66,617
	4,022	5,945	31,902	92,096
Foreign & Colonial Sugars.				
Refined and Candy	178	156	443	825
Unrefined	68	191	459	432
Various Mixed in Bond	....	....	....	....
Molasses	150	572	3,415	5,492
Total Exports	**4,418**	**6,864**	**36,219**	**98,845**

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to June 22nd	2,052,060	..	1,700,768
Deliveries „ „	1,760,771	..	1,434,076
Meltings „ „	1,517,083	..	1,285,450
Exports of Refined „ „	49,000	..	45,845
Importers' Stocks, June 22nd	389,520	..	375,232
Total Stocks, June 22nd	697,932	..	544,254
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT MAY 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	1,825,699	..	1,610,606	..	2,445,303
Stocks	1,357,045	..	1,270,621	..	1,439,050
	3,182,744		2,881,227	..	3,884,353
Local Consumption..	51,000	..	41,924	..	31,181
Receipts at Ports to May 31st ..	3,233,744	..	2,923,151	..	3,915,534

Habana, May 31st, 1929. J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR SIX MONTHS ENDING JUNE 30TH, 1927, 1928, AND 1929.

IMPORTS.	1927. Tons.		1928. Tons.		1929. Tons.
Refined.. ..	280,469	..	169,616	..	28,588
Raw	597,904	..	876,900	..	1,013,229
Molasses	54,957	..	119.182	..	134,821
	933,330		1,165,698		1,176,698

EXPORTS (Foreign).	1927. Tons.		1928. Tons.		1929. Tons.
Refined........	962	..	443	..	825
Raw...........	496	..	459	..	432
Molasses	172	..	3,415	..	5,492
	1,630		4,317		6,749

HOME CONSUMPTION OF IMPORTED SUGAR.

	1927. Tons.		1928. Tons.		1929. Tons.
Refined	290,585	..	160,551	..	28,818
*Refined (in Bond) in the United Kingdom	380,044	..	325,400	..	360
†Raw	74,419	..	351,600	..	995,940
Total of Sugar	745,048		837,551		1,025,118
Molasses..	2,900	..	3,351	..	5,096
Molasses, manufactured (in Bond) in United Kingdom ..	45,317	..	31,068	..	1
	793,265		871,970		1,030,215

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT JUNE 30TH.

	1927. Tons.		1928. Tons.		1929. Tons.
Manufactured from Home Grown Beet	2,350	..	14,800	..	15,150
Refined in Bond	78,350	..	31,700	...	7,400
Foreign Refined	92,650	..	30,050	..	10,650
„ Unrefined	219,750	..	235,750	..	126,050
	393,100		312,300		159,250

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 180,259 tons entered for refining in refineries in the month ended 30th June, 1929, and 920,482 tons in the six months ended 30th June, 1929.

United Kingdom Monthly Sugar Report.

Our last report was dated June 10th, 1929.

A great change has taken place in the sugar markets chiefly during the past month, values being so low at one time that it was inevitable that a reaction must take place. Sentiment generally has changed more in favour of sugar, and the low prices have brought into being International Conferences, first at Geneva and then at Brussels to try and find some basis for regulating the world's supply. The latest news is that there is a possibility of an agreement between Java, Europe and Cuba to limit their crops over the next four or five years.

The London Terminal Markets have been active. In the White section there has been a sharp advance. August sold as low as 9s. 3¾d., which recovered to 11s. 6d. and which has reacted to 11s. 1½d., whilst December sold at 9s. 9¾d. to 12s. 1½d. to 11s. 9d. March sold up to 12s. 3d., May to 12s. 6d. The Raw section has been very active, and continuous covering and fresh buying orders have driven prices up. August sold from 7s. 1½d. to 9s. to 8s. 6d., December 7s. 6¾d. to 9s. 6d. to 9s. 1½d., March from 7s. 9¾d. to 9s. 9d. to 9s. 4½d. and May from 8s. to 10s. 0¾d. to 9s. 8¼d. The latest prices are :—

	AUGUST	DECEMBER	MARCH	MAY
White	11s. 1½d. ..	11s. 9d. ..	12s. 0d. ..	12s. 3d.
Raw	8s. 6¾d. ..	9s. 1½d. ..	9s. 4½d. ..	9s. 8¼d.

Dealings in actual sugar, which have been in the main confined to Home Grown and British Refined, have been large, and the Refiners have made continual advances; on June 14th by 1½d., June 17th by 4½d., June 18th, 3d., June 19th, 3d., June 25th, 3d., June 29th, 3d., July 2nd, 3d., July 6th, 3d. Their latest prices are No. 1 Cubes 27s. 3d., London Granulated 24s. 1½d. Prices for Home Grown have also advanced by 2s. per cwt. from the bottom, their latest prices to-day being 23s. 1½d. to 23s. 4½d. according to factory.

Continental Sugar has been firm. Granulated f.o.b. has risen to 11s. 9d.

A large business has been done in Raws from 7s. 10½d. to 9s. 4½d. c.i.f., although the "pool" is holding for 10s.

The American market has been continuously firm. Cubans sold up to $2\frac{1}{16}$ at which price there are sellers to-day. The Futures market also advanced about 40 points.

There is nothing fresh from Europe, although it is understood that the crop is progressing satisfactorily.

The Cuban production to date is 5,156,000 tons, and exports are now over 1,000,000 tons in excess of last year, so that the stock in the island is only about 100,000 tons higher than at this time in 1928.

21, Mincing Lane,
London, E.C.3.
10th July, 1929.

ARTHUR B. HODGE.
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 368. AUGUST, 1929. Vol. XXXI.

Notes and Comments.

The Outlook.

Three things have contributed of late to keep the world sugar market in a disturbed state : Cuba's intentions with regard to her coming crop, the uncertainty as to how far the new American tariff will pass unrevised if it passes at all, and the existence of secret negotiations at Brussels between some of the principal producers with a view to evolving some scheme of sugar control acceptable to the majority. These are all more or less momentous issues, and till the outcome of each is known the sugar market is hardly likely to be able to indulge in other than hand-to-mouth dealing.

The Brussels Conference undoubtedly ranks first in importance. Following on the meetings at Geneva of the Sugar Economic Committee of the League of Nations, the Belgian sugar industry issued an invitation to the principal representatives of the sugar industries most concerned to meet at Brussels and discuss ways and means of solving the over-production problem. It is understood that the invitation was accepted by representatives of Czechoslovakia, Poland, Germany, Belgium, Hungary and Cuba. These met and apparently came to some tentative agreement amongst themselves; but without the co-operation of Java nothing of permanent value was possible, so the Conference dispatched a delegation to Amsterdam to try and induce the Java Producers' Association to join the Conference. This was the position at the beginning of July. Since then secrecy has been maintained and we are dependent on a crop of rumours as to what has transpired. All one knows for certain is that the Conference has continued to meet at intervals for the past month. It is believed that the Java producers are accepting the invitation, though at the time of writing there is no official news to that effect. Rumours ascribe to the Conference the intention to regulate production and marketing for a period of four years. If this proved to be the aim of the participants, including of course Java, it would mean that no curtailment of the present output would be attempted, but that by restricting further expansion it would allow consumption with its annual increase of 3 or 3½ per cent. to catch up with production. As for Java, the reasons that led her a year ago to decline to come into the Conference are not so cogent now. She was then on the eve of reaping a record crop from an unprecedentedly productive type of cane. But since then the low prices ruling have cut down Java factory profits to a figure that will give even the Dutch cause to think

that unlimited competition is not a wholly unmixed blessing. A good price on a limited crop may well pay better than a low one on an unrestricted crop—especially in a country like Java where there are no new vast areas of land to be tapped and added to the cane acreage.

As for Cuba, rumours relating to a new crop restriction remain for the moment unsolved. All we know is that the President has decided on creating a single selling agency for the disposal of the balance of present crop sugars unsold by the end of August and of the entire 1930 production, and has signed a decree to that effect. In the matter of crop restriction natural causes have intervened this year; according to a correspondent of ours who contributes an interesting article on Cuba on another page, the greatest drought in five years was experienced during the first five months of 1929 and will result in some areas of cane being abandoned as unprofitable, while last year's average yield is not expected in the coming season. The result of these adverse factors may easily be a 10 per cent. reduction on the output. This fact may be a major argument when the President comes to make his final decision with regard to allowing unrestricted cropping or the reverse.

Mr. Snowden and the Preference Duties on Sugar.

Our survey of the political situation at home as given in our last issue was necessarily incomplete in the absence of any dictum of Mr. SNOWDEN, the new Labour Chancellor of the Exchequer; but a day or two later he supplied the sugar world with the eagerly awaited statement as to his probable intentions with regard to the sugar duties. While not committing himself to any definite pronouncement in advance of his first Budget—due some time next Spring—he made it clear that he nourished the hope of being able ere his Government left office to sweep away all duties on food, including of course sugar. When those duties were swept away, the preferences would naturally go with them.

The first effect of this hint has been to disturb the sugar industry to a considerable extent; it has engendered a feeling of uncertainty which will hamper all plans for the future; certainly it has alarmed those Dominions and Colonies that have benefited for some years past by the existence of a U.K. preferential market for their sugar. In particular Australia is much concerned at the threat to her sugar thereby implied. Both the Commonwealth Prime Minister and the Australian Labour Party leader have hastened to declare that the abolition of the preference on sugar would be a serious blow to Australia. In South Africa, also, Mr. SNOWDEN's remarks have been received with dismay, and with the feeling that they put the pro-British opponents of the German Treaty in a more difficult position. At home the abolition of the sugar duties if carried into effect would, as a well known market expert points out, lead to a re-shuffling of relative values between raws and refined sugar, between sugar prices prior to and after the Budget, to the re-admission of foreign white sugars to this country, which latter would mean that the home refiners would lose their monopoly of our refined sugar market. There would also be the problem of the Home Grown sugar quota, but as the subsidy on such sugar is a declining preference and is due to disappear in a few years, the Labour Party, who were part sponsors of it, are hardly likely to terminate its operations prematurely. This, then, is the apparent position threatened if Mr. SNOWDEN's inclinations are translated into action.

But as a writer in *The Times* remarks, Mr. SNOWDEN's statement "is probably to be regarded more as a declaration of the orthodoxy of his own

fiscal faith than as a statement of Government policy; the words of the Chancellor need not be taken literally." Obviously it is one thing to express one's fiscal beliefs and another lightly to forego a set of duties which bring to the Exchequer a sum of between 17 and 20 millions sterling per annum. These duties are not primarily protective; they are in effect old-established revenue duties. In view of the well known desire of the Labour Party for certain domestic reforms that will require money wherewith to fund them, not even a Labour Chancellor of the Exchequer can complacently afford to lose established revenue. Nor, one would think, can he afford to ignore without very good grounds the protests of Labour Governments in the Dominions just when these are being approached by another member of the Cabinet to help to solve the unemployment problem at home. Australia, for example, has a sugar industry built up with full Labour approval and appreciation. She has experienced the benefit of having a market in the United Kingdom for the surplus of her expensively produced sugars and naturally demurs to losing it. These sugars are expensive to produce for reasons that the Labour doctrinaire at home should amply appreciate if he took the trouble to study the subject.

It should be noted, moreover, that Mr. Snowden stated in the same speech that his Government desired to promote the closest commercial relations with every part of the Empire, and were negotiating even then with the Dominions to see whether it might be possible to hold an Imperial Economic Conference to see what could be done to extend inter-Imperial trade. Mr. Thomas, the unofficial minister for unemployment, is also busy investigating possibilities for finding work overseas for our surplus labour at home. It is therefore apparent that the new Labour Government between now and next Spring will be put in possession of the views of the Empire Governments concerned and will doubtless develop a more catholic view of what is best in the circumstances; they will certainly realize that concessions cannot be all on one side.

For these reasons we are far from disposed to take an alarmist view at this early stage of certain theoretic enunciations which it may never be practicable to carry out. This is a day of *rapprochement* and co-operation between nations in the cause of peace and goodwill, and the Empire has its own special problem of amity and reciprocity to work out. No home Government can, whatever its predilections, any longer afford to ignore this new trend of feeling, nor can our fiscal legislation be framed wholly regardless of its effect on our kin overseas. The vogue of Little Englandism was virtually destroyed by the Great War.

The Empire Marketing Board.

The third annual report of the British "Empire Marketing Board," a Government Department lately created to further the marketing in the United Kingdom of Empire products, would appear to show that its creation has been fully justified. The Board's funds, in accordance with the recommendations of the Imperial Economic Committee, have been devoted to scientific research, economic investigation, and publicity. It is pointed out that the immense and growing power of science to help the producer has not in the past been so thoroughly mobilized within the Empire as elsewhere in the world, and the whole aim of the Board has been to remedy this. They have therefore seized many opportunities of financing scientific research of urgent importance to Empire marketing; as an instance, they have established eight new Imperial scientific bureaux, and appointed a Colonial Advisory Council of Agriculture and Animal Health. This scientific research aims

amongst other things at devising means to render production as economical as possible, by reducing waste in the field, in transit, and in store. As to the results to be obtained, it is necessary to take the long view, but it would appear that since the Board commenced activities a remarkable increase has already taken place in trade within the Empire. Sugar for fairly obvious reasons does not loom large in the immediate results ; it is an old established Empire product and of recent years it has benefited chiefly through fiscal expedients, but it stands in just as much need as other industries of scientific aid and a sound economic policy ; and the general results achieved by the scientific staff of the Marketing Board are bound in the long run to influence the sugar industry amongst others.

At home the most apparent outcome of the Board's activities has been the spectacular advertising in the press and on posters. This has helped without doubt to create a demand amongst the public for the products that the Empire offers. It suggests food for thought, in that a like form of propaganda suitably placed might have a not inappreciable effect on the demand for sugar, especially in those countries where the per capita figure is still excessively low, based on Anglo-Saxon rates of consumption. Those who have faith in the possibilities of such a scheme designed to aid the world sugar industry generally might do worse than investigate the advertising activities of the Empire Marketing Board.

The Progress of Soil Science.

In these days of over-production and the consequent intensive competition for markets, the agriculturist in the tropics is everywhere putting his house into order. On the one hand, attempts are being made to eliminate inferior types among the crops and to evolve more productive strains and, on the other, to improve the soil so as to get more out of it. In both cases the dominating idea is to lower the cost of production, and scientific economists are entering the comparatively unexplored field with enthusiasm. Taking the soil, nothing is more remarkable than the thoroughness with which all the old conceptions of its characters are being overhauled. New ideas have been formed as to its constitution, and a whole new technique has been evolved among the workers, with its own special language which, though obviously necessary, strikes the general reader as a strange and terrifying jargon. And to translate this language into plain English is a very difficult piece of work ; even the experts find it surprisingly difficult when they make the attempt.

These new ideas are now being applied in various directions to tropical soils, and already some noteworthy results have been obtained. The soils of the tropics are, however, very different from those in temperate regions. The factors which, in the main, are responsible for their formation, while fundamentally the same everywhere, have been found to have very different relative values when compared with those in temperate regions, where soil science has been gradually built up. And, of course, the same applies to the continuance of the action of these and other factors as regards the maintenance of soil fertility. Finality cannot therefore be expected at present. The workers in the tropics are few and far between, and the soils of the different countries are very diverse ; and any tendency towards generalization should be restricted within narrow limits. On another page attention is drawn to soil work in Trinidad, on the influence of soil conditions on the severity of the attack by a certain pest. The paper reviewed finds occasion to include a summary of the prevailing ideas as to the constitution of the soil. This part, although written in semi-popular style, will be somewhat difficult reading in places and,

in reviewing it a further simplification has been aimed at. At the same time what appear to be controversial points have been left out altogether. The soil studies being conducted in Trinidad are evoking considerable interest, and this interest will of course be great wherever the soils have been found to render the growth of healthy cane crops difficult. From the evidence, this island appears to be rather unfortunate in its cane soils, or at any rate in a considerable portion of them ; and any improvement which can be effected at little cost assumes great importance in the present conditions of the industry.

The Year 1928 in Jamaica.

According to the Annual Report of the Jamaica Department of Agriculture for 1928, that year was from the agricultural point of view a difficult and disappointing one. The high hopes with which it started were defeated, owing to a very sharp drought ; but during the hurricane months Jamaica fortunately escaped the cyclones which did so much damage to other islands in the West Indies. As a consequence of the drought the sugar crop failed to realize expectations ; originally placed at 60,000 tons, it only yielded an export of 48,714 tons of sugar, while prices were also low. With the failure and abandonment of crop restriction in Cuba, the industry was faced with severe competition and a period of low prices. A bold effort has been made to meet this situation by increasing the output of the fields. Deep cultivation by mechanical tillage and the selection of improved canes have combined to raise the yield on large areas of sugar land by at least 25 per cent. In fact it is remarkable to note that on the estates where such mechanical tillage is employed, and where the method of knifing the soil instead of turning it with the mould board plough has been followed, there has been a considerable increase in tonnage, and in some instances the increase for BH 10 (12) and Ba 11569 over the White Transparent in the same areas has been from 40 to 50 per cent. and sometimes 100 per cent.

Until about 1920 no seedling canes that had been tested in Jamaica could effectively replace the White Transparent. During recent years certain canes from Barbados and Java have been introduced which are definitely superior in all respects to the old Jamaica cane. For the best soils and climate BH 10 (12) gives large tonnage and rich juice. On heavy soils with adequate water or rainfall Ba 11569 has more than double the yield of White Transparent ; it is a first class factory cane. As a substitute for Uba cane where mosaic is rampant the Java POJ 2725 is recommended ; this cane requires early fall planting to get the best results ; it is a strong grower and yields a rich juice. The Hawaiian H 109 is a magnificent variety but requires plenty of moisture, for under dry conditions in Jamaica it becomes hollow in the centre, and can only be recommended for planting where conditions are most favourable for free and unrestricted growth.

The problem of rum remains a difficult one, although the trade was rather greater than for 1927. Recently, definite steps have been taken to put the better cane lands in Jamaica into bananas, pending an improvement in the markets of the world for sugar. The prospects for the future are, therefore, for a reduction in the output of sugar until this staple again becomes attractive to the producer. There is, however, a definite area of sugar land where the banana can not be grown successfully and the productive capacity of these lands under present conditions may be set at about 35,000 tons of sugar per annum, in addition to local requirements.

The Effect of Low Prices on the Beet Sugar Industry.

As showing the extent to which the present era of low sugar prices is adversely affecting the European sugar industry two recent Department of Overseas Trade Reports may be quoted. In Belgium the position of the industry generally is gravely threatened. And the success or failure of the beet crop there reacts upon the whole of the agricultural economic position. At present the market rates for sugar do not allow of a sufficient price being paid to render beetroot growing remunerative, and a steady retrogression of cultivation is the result. The area planted in 1928 was 57,000 hectares, in 1927 63,000 and in 1926 about 70,000 hectares. The 1928 yield averaged 27-30,000 kilograms per hectare, with 17.5 per cent. sugar content. The quantity of roots dealt with in 1928-9 at the Belgian usines—about 1½ million tons—is only about 75 per cent. of that needed to give them a profitable outturn. Many interests in Belgium are now urging, as might be expected, that the Government should follow the example of France, Germany, and England, and protect the industry further by placing a premium on production.

In Denmark the industry is reported to be in a very healthy condition owing to the fact that the world price of sugar is less than that at which it can be economically produced in Denmark, and here also the Government is being asked to intervene by increasing the existing non-protective import duty (4½ Ore per kilo.). The fertility of the land where the roots are grown and the strong financial position of the Danish sugar factories have so far combined to sustain the industry. The area under beet which advanced by no less than 40 per cent. from 1926 to 1927 was again enlarged last year to the extent of 8 per cent.

But the price of sugar has fallen to the level of 1911, though raw materials cost half as much again and labour twice as much, and imports have increased from 11,000 metric tons in 1927 to 40,000 tons in 1928. At a pinch the factories can continue earning profits by refining a greater quantity of imported raw sugar, but the matter does not stop there. With consumption at 50 kilos per head (as compared with 36 in great Britain, 35 in Sweden and 21 in Germany) the home production, which amounted last year to 165,000 tons of raw sugar, is of considerable importance from the point of view of the balance of foreign trade, in addition to being a valuable source of income which farmers in present circumstances can ill afford to lose. Even so, if the situation is not dealt with, a shrinkage in the present area under beet (65,000 acres) seems inevitable and it is feared that a change over to other forms of production in the affected districts may have a disturbing effect on prices, especially if the change results in a sudden rise in pig production. It should be mentioned that the increased production of beetroot has in part been influenced by the fact that this root has latterly been extensively used as a substitute for other more expensive kinds of fodder.

Producing under Difficulties in Trinidad.

If we turn to the West Indies, we find the effect there of low prices for cane sugar exemplified in the annual report of the Caroni Sugar Estates (Trinidad) Ltd., for the year 1928. The net profit from the working of this factory with its capitalization of £420,000 was no more than £22,141, and the directors could not do otherwise than conserve it for future eventualities and pass all dividends. The Chairman (Mr. J. G. Miller) at the annual meeting dwelt on the acute crisis through which the sugar industry was now

passing. There is a difference of fully £5 per ton in the price of raws since the beginning of last year ; the world's market price then was about £12 per ton f.o.b. shipping port, while last June it had dropped to the equivalent of under £7 per ton, the lowest figure recorded for sugar since the year 1902. So serious is the present position that he believed it would make all sections face facts and strive to find remedies which would place this world industry on a profitable basis. Therein lay our hope for the future.

Mr. MILLER also emphasized the value of Preference to the West Indian market, but for which the British West Indian sugar industry would have been extinguished by now. Moreover, in return the colonies have been taking more manufactured articles from the mother country. Trinidad alone spends on an average close upon £250,000 a year in materials for repairs and renewals to factories and for estate supplies. Within the last few years, also, orders in the home country for new sugar machinery for Colonial factories have reached a million sterling in value.

Liming the Soil and Trinidad Work.

In the current number of the *Agricultural Journal of British Guiana*, a short and interesting account is given by FOLLETT-SMITH[1] of the conclusions arrived at from the work of Professor HARDY and his assistants on the influence of the character of the soil upon the frog-hopper blight in Trinidad. In 1927 he showed that, in general, the frog-hopper infestations were worst in soils with an acid reaction, while those with an alkaline were able to grow canes more or less free from this pest. Liming is the usual and obvious method of correcting this acidity, and the author concludes his paper with a discussion of possible means for initiating an efficient programme of liming on Trinidad estates. In his introduction, he remarks that the regular dressings of lime practised in temperate regions have resulted in maintaining the fertility of the soil for long periods, but in the tropics, where heavy rains leach out the soil more rapidly and thoroughly and the rotation of crops is much less practised, the soil is prone to become deficient in lime, with resulting acidity ; and " it is only recently that the problem of liming the cultivated soils in the tropics has received the attention which it merits."

A few words may be said here in defence of this absence of liming in the tropics. The application of lime to the soil in any form differs from that of most other substances in the large quantities required ; and there are immense areas in the tropics where there is a total absence of the limestone formations from which supplies could be drawn, especially where the parent rock is of very old geological origin. Here the preparation of lime, which is everywhere practised, is a difficult and costly process ; and the costs of transport from the nearest sources place it altogether outside the possibility of application to the fields. This, no doubt, explains the fact that we look in vain for any references to liming in the scattered remarks on agriculture in the ancient Indian literature. In the Vedic age (B.C. 2000 to 1400) agriculture was, as it is now, the main occupation of the people ; and it reached a high stage in efficiency, as will be seen from the following notes.[2] Ploughing was done by an implement which appears to be very similar to that used now ; but it was apparently better done, because considerably more cattle were used, with probably a

1 Liming of Tropical Soils. R. R. FOLLETT-SMITH. *The Agricultural Journal of British Guiana.* Vol. II, No. 2, June 1929.

2 *Journal Madras Agricultural Students' Union*, VIII, 2-4, 1920.

deeper working of the soil. Manuring was practised, and cattle manure was preferred to all others, while irrigation reached a high stage of development. Soils were, somewhat later, classified according to colour, into white, yellow, red, grey and black (the most fertile), and according to taste, into sweet, acid, salt, bitter and astringent; and the suitability of these for various crops was known. Incidentally "salt" land (probably mostly alkaline) was known and feared. It was divided into three classes, according to the amount of salt present, and the remedies mentioned are the application of sand, ashes from cereal straw, nim and other oil cakes, and green manuring with indigo and sann hemp. If limestone were available, it is fair to assume that its use would have been known and practised for the correction of acid soils.

The paper commences with an enumeration of the benefits of liming—improvement of the physical character of the soil, correction of acidity, and the provision of calcium as a necessary plant food. The author then presents in brief outlines the modern conception of the composition and the properties of the soil, the gist of which is as follows. It is to its finest particles, such as those technically known as "clay," that any soil owes its character: a heavy clay soil has a large proportion of them, while a light, sandy soil has comparatively few, its bulk being made up of larger particles. These minute particles have special characters of their own, not shared in by those of a greater size. They are likened by the author to sponges, expanding when wetted and shrinking when dried. Their most important character, however, is their ability to retain on their surfaces loosely held and replaceable bodies termed "ions," principally metallic bases, but also sometimes hydrogen. The metallic ions in the main comprise calcium, magnesium, sodium and potassium. When the particles are occupied by any particular ion to the exclusion of the rest, the soil is said to be satisfied or saturated with respect to that ion. The amount required for the saturation of any soil will, obviously, depend on the proportion of the finest particles; and a sandy soil will be more easily satisfied than a clay one. To express the degree of saturation with respect to any particular ion, it has been found convenient to state the amount found to be absorbed as a percentage of the total absorptive capacity of the soil.

The properties of these minute particles of the soil (and consequently of the soil as a whole) depend on the metallic bases attached to them. For example, if sodium is the ion attached, the compound is less stable than when the calcium ion is attached; an alkaline solution is readily formed which, as we shall see, tends to keep the particles separate and prevents them from forming little groups. In neutral soils, calcium amounts to about 80 per cent. of the possible ions required to saturate the soil with it. Such a soil has its particles flocculated or aggregated into small groups, and is therefore permeable and easily worked, shrinkage is not excessive on drying, and the density is low. When, on the other hand, sodium predominates among the ions, the particles are kept apart or dispersed, the soil becomes impermeable, sticky and difficult to work, shrinkage is excessive on drying and the density is high. From which it is clear in what way the replacement of ions by calcium benefits the physical conditions of the soil. Any of these ions will replace one already in possession of the surface of the particles, in proportion to the amount added to the soil; so that the addition to the soil of calcium in a suitable form and in sufficient quantity acts automatically in establishing the calcium ions in the particles.

It has been demonstrated that those Trinidad soils, which are less than 60 per cent. saturated with calcium, produce canes regularly blighted by frog-

hoppers; whereas, when saturation approaches totality, the canes growing are unattacked. In the same way, it has been shown that canes growing on calcium-satisfied soil are more efficient plants than when they are grown in an acid, calcium-deficient environment. Only with approximately 80 per cent. of the absorptive capacity of the soil for calcium, will it possess the good tilth and generally desirable physical characters for cane growth.

When, in place of the metallic ions, that of hydrogen dominates, the soil becomes acid; and the correction of this acidity is usually best effected by the addition of sufficient quantities of lime in a suitable form to evict the hydrogen ions and provide a moderately lime-saturated soil. Acidity in the soil may be due to a variety of causes, and it may have various prejudicial effects. The chief of the latter may be either the harmful effect of the acidity on the plant itself, toxic effects induced by chemical reactions among the ions, or a baneful influence upon the soil bacteria. As regards the latter, "it is known that the micro-organisms responsible for cellulose breakdown thrive best of all in neutral or slightly alkaline media. One of the characteristics of a sour soil, undisturbed by cultivation, is the appearance of a mat of dead vegetation upon the surface of the soil consequent upon the diminished activities of micro-organisms. Nitrification, too, proceeds more readily at neutral reaction. Azotobacter, an organism responsible for the direct fixation of nitrogen, is very intolerant of acid conditions (below *pH* 6·0). The bacteria of legume root nodules are also sensitive to acid conditions." Similarly, in this country, certain disease organisms exist in the soils with acid reaction (between *pH* 3·7 and 6·6), but cannot exist in soils with an alkaline reaction. The question of the availability of aluminium and iron, and their toxic effect is next explored, as correlated with injurious acid conditions of the soil; and other possible sources of the inhibition of healthy plant growth of crops are referred to; but for the purposes of this article this portion of the paper is omitted: it is rather too technical for general treatment, is little understood, and in places, at any rate, is at present in the controversial stage.

The author next proceeds to a practical consideration of the best source of lime in the tropics for agricultural purposes. The efficiency of manuring depends, in the first instance, on the extent of the surface area exposed to the soil by the material applied; and this surface area varies with the fineness of sub-division of the dressing applied. "One ton of limestone ground to pass a hundred-mesh-to-the-inch sieve will possess a surface area ten times as large as will one ton of limestone passing only a ten-mesh-to-the-inch sieve. The degree of sub-division of the dressing is therefore of paramount importance with regard to its efficiency." It may be remarked that there appears to be a slip here in the author's figures. Nothing is more surprising than the great extension in surface area of a given weight of a substance, when it is subdivided into smaller and smaller particles; and, if we are not mistaken, the increase in total surface area obtained by decreasing the diameter of the particles ten times is vastly greater than the figure given.

Owing mainly to this fineness of particles, the powdery slaked and burnt lime has long been preferred to limestone for manurial purposes. But, with the improved modern machinery for pulverizing limestone, this preference should disappear. In fact, the author quotes a recent experiment on an estate scale in the tropics (presumably in Trinidad), where the three forms of lime were compared: "A dressing of limestone was the only application which produced a significant increase in the yield of cane and a definite rise in the degree of saturation of the soil with respect to lime." There are

also several practical advantages in the use of limestone mentioned by the author, one of which is of special importance in the tropics; namely, that this form of lime may be stored indefinitely without fear of deterioration, while it is easily applied with a minimum of discomfort to the workers. No definite specification has been formulated for pulverized limestone, but it is agreed that it should be finely divided and that there should be only a small proportion of magnesium carbonate in it. Difficulty may be experienced if the fineness is excessive; and the following is given as meeting the case: all the material should pass a sieve with ten meshes to the inch, and at least 50 per cent. should pass the 100 to the inch mesh.

With regard to application it is observed that, not only should the soil particles be saturated with respect to calcium, but there should be a reserve in the soil, if optimum conditions of soil tilth are to be maintained. Otherwise, with continual small withdrawals the store of lime will be gradually exhausted, the permeability of the soil be impaired, and a new large dressing may therefore take a comparatively long time to take effect. Periodic small dressings are therefore indicated, once the lime status has been satisfactorily established. With an unsaturated soil, however, a single large application will be more profitable than will small annual dressings. Obviously, thorough incorporation with the soil should be always obtained. "Experience in Trinidad has shown that dressings of limestone did not penetrate to any extent below the level to which the soil was worked"—a rather significant statement which appears to require consideration. As to the duration of the effect following an application of lime in the tropics, no definite statement can be made, because of the interplay of so many varying factors. Heavy soils will naturally retain their content longer than light ones and, taking into account the more intense leaching effect of the tropical rains, it seems probable that the duration of the effect will be shorter in the tropics than in temperate regions. Remaining paragraphs deal with the initiation of a programme for estate liming in Trinidad, indicating the necessity of a thorough study of the lime status in the fields, a study of yield responses, and periodic laboratory examinations in order to place the chemist in a position to predict performance. Indications of an unsaturated state are shown by bad cracking of the soil, its great mechanical strength when dry and its disinclination to crumble in consequence. The various laboratory tests are then passed in short review, and a summary is given of the paper, with about a dozen more important references, which can be studied by those interested for further understanding of the difficult problems involved.

C. A. B.

OBITUARY.—The death is announced of Mr. Archibald McArthur Lang, a Director of Messrs. Fawcett, Preston & Co. Ltd., of Liverpool, which took place on July 13th, following on an operation.

U.S. SUGAR CONSUMPTION.—Messrs. Willett & Gray calculate the "indicated consumption of sugar" in the United States for the first six months of 1929 as 3,009,377 long tons, refined value, as compared with 2,654,935 tons in the corresponding period of 1928. This represents an increase of about 13 per cent.

ANGLO-CEYLON CO.—The Mauritius sugar factories of the Anglo-Ceylon & General Estates Co. Ltd., during the 1928-29 season handled 162,826 tons of cane, of which 119,661 tons were grown on the factory estate and 43,165 tons were bought from outside; these produced a crop of 18,030 tons of sugar, as against 16,104 tons in 1927-28 from 152,176 tons of canes. Prices ruled about £2. 15s. per ton lower than in the previous season, but the larger crop and a further reduction in the cost of production enabled a profit to be earned.

Sugar Cane Roots in the Philippines.

Considering his former work in Hawaii, it is not surprising that H. ATHERTON LEE should quickly turn his attention to root dissection after his transfer to the Philippines; and the following is an abstract of a paper describing his work there.[1] By all accounts the sugar industry is on a very different plane there; the standard canes are also different, and the soils especially show little resemblance to those in the Hawaiian Islands, while the cultivation is far less intensive. The study was carried out on the Calamba Sugar Estate, where the prevailing soil is heavy while the subsoil appears to be somewhat unusual in character. The soil is described as compact and rather shallow. It is underlain by what is locally termed "adobe rock." This rock is very soft, quite porous, and disintegrates very rapidly. "In some of the plots the rock actually came within the part excavated (two feet), and while roots were found running through every crevice the amount of roots would be expected to be reduced." In such circumstances one might expect distinct alterations in the distribution of cane roots in the soil from that in Hawaii; but this is not very apparent in the results of the observations made.

The method adopted in studying the distribution of the roots is shortly described, and is apparently identical with that employed by LEE in Hawaii. An area was selected with representative stools of cane, and five of these were separated off within marked lines. After determining the base level of the surface, the stools were cut off there and weighed. Then 8 in. layers of soil were dug out and examined in succession, till no appreciable roots were met with; in this case three 8 in. layers were found to be sufficient. To separate the roots dug out from the soil, this was reduced to a powdery condition, and the fine earth thrown against a slanting wire screen of $\frac{1}{4}$ in. mesh, such as is commonly used for screening sand for mortar or cement. In this process the roots are retained on the wire and the fine soil passes through. The roots of each layer were separately bagged, oven dried and weighed.

Experiment 1.—Pampanga Red, 12 months old, plant canes nearing maturity. Three fields, under identical cultivation and near together, were selected and manured as follows. The first field was unmanured; the second received a complete manure at the rate of 250 kg. per hectare, whose constituents were in the proportions of 10 per cent. nitrogen, 6 phosphoric acid, and 2 of potash; the third field had an application of 250 kg. per hectare of sulphate of ammonia. The first plot had six stools in it, and there were five in each of the others; but it is difficult to understand the number of cubic feet excavated in the three plots, this being 39, 39, and 64·5 respectively. Without further information we must presume that these differences were due to differing spacing of the canes in the three plots, or to the plots being of different size.

The results of the experiments were as follows. Giving the plots in the same order as above, the total weights of dried roots were 70·2 grms., 42·4 grms. and 56·4 grms.; the weights of undried canes and tops, 2600 grms., 3520 grms., and 2520 grms; ratio of tops to roots, 37·0, 83·0 and 44·6; weights of roots to the cubic foot, 10·8 grms., 5·4 grms. and 4·3 grms. The percentage of roots recovered from the three 8 in. layers were: for the top layer 74·2, 78·3, 71·2; for the second layer, 20·6, 17·2, 22·9; and for the third layer, 5·1, 4·5, 5·9.

The authors comment as usual on the greater proportion of roots in the upper 8 in. of soil, this being greater even than in Hawaiian experiments. They also refer to the close similarity of the relative percentages, of the roots

[1] "The Study of Sugar Cane Roots in the Island of Luzon." H. ATHERTON LEE and G. H. BISSINGER. *Sugar News*, August, 1928.

in the different layers, under the three manurial treatments. The greater ratio of plant weights to dried roots in the manured plots as compared with the unmanured is noted; and they conclude that "quantity of roots above a certain minimum is not a very important factor in the production of cane tonnage"; the presence of ample supplies of nutriment is more important and, given this, the plant can do with a less extensive root system. They do not refer to the fact that the N plot is rather similar in yield to the unmanured, while the tonnage on the plot with complete manure is considerably greater than either.

Experiment 2.—Luzon White, first ratoons nine months old, unirrigated, and the rows hilled up from 5 to 6 in. above the middle of the row. In the fields chosen there were four different manurial treatments, no manure, 50 kg. N per hectare, 50 kg. N + 24 kg. phosphoric acid, 50 kg. N + 25 kg. potash. The results are given in Table II and are here repeated as in Experiment 1, the four manurial plots being given in the above order. There were five stools in each plot.

Total weights of dried roots in grms : 47·6, 65·2, 104·4, 79·2.

Cane tonnage per hectare in field : 29·2, 45·96, 44·14, 41·40.

Cubic feet excavated : 27·4, 36·94, 67·62, 39·00.

Weights of roots per cubic foot of soil in grms : 8·65, 8·83, 7·72, 10·13.

The percentages of roots in the different 8 in. layers, again three in number were : Top layer, 52·1, 61·5, 66·2, 64·6 ; middle layer, 34·8, 27·4, 24·7, 25·7 ; and bottom layer, 13·0, 11·0, 9·0, 9·6.

The authors make the following remarks on these figures. The greatest proportion of roots was still in the uppermost 8 in.; but the hilling up probably decreased the percentage of roots near the surface, as it has been found to do so in all other cases. The unmanured plot had at least as great a weight of roots as the manured. The canes had already been harvested when the excavations were made, so the tonnage obtained in the fields is given in place of the actual weights of tops and canes. The results again emphasize the necessity of using the same number of stools, with the same amount of excavated soil (presumably by examining canes planted at equal distances). The wider distribution of the roots in the unmanured plot is not referred to.

As to practical applications, they point out the need of keeping the manures applied as near to the surface as possible, because of the greater number of roots developed there. "There is no evidence to indicate that fertilizers attract the roots downwards. Therefore if the fertilizers are washed down below the 8 in. level of soil, they are lost to 60 per cent. of the roots. As relates to drainage these studies indicate that the water table should at least be kept 24 in. from the soil surface, and aeration encouraged to a depth of at least 4 in. As regards irrigation it would seem logical to attempt to get the moisture to the topmost 8 in.; it would be expected that in this event the moisture in the lower levels of soils would take care of itself. The studies indicate that in soil sampling we need not concern ourselves with the soil below the 24 in. level and in fact we are most concerned with the soil in the topmost 8 in. of soil."

NOTE BY THE WRITER.—The study of the roots of a plant is of necessity an extremely laborious and difficult matter, and any method which can be devised to ease the work will be very welcome, especially as, in the nature of the case, it is essential for the study to be repeated in as large a range of conditions as possible, and, also, with crops such as the sugar cane, with many varieties. The method last described has the advantage of not needing any

great technical skill or very close supervision, and may within certain limits even be considered "fool-proof"; but it has many disadvantages, some of which have, on occasion, been referred to in this Journal. It takes no cognizance of whether the roots are dead or still living, nor does it distinguish between the parts of the root which are actively absorbing and those which have left this stage behind, and are mere channels along which nutrient fluids are being passed. Undoubtedly, some of the finer roots, and especially their ends, are lost in the method adopted. The errors thus involved are deserving of special study, and this should not be difficult. It is suggested that selected samples might be submitted to detailed analysis, after the component parts had been softened by water.

There is, admittedly, very little branching in cane roots as compared with most other crops; and this means that in some layers of soil the proportion of transmitting to absorbing portions may be very large. Indeed, allowing that, in any plant, the absorbing portion of a root is confined to small areas near to the ultimate ends of its branches, we see that, on the whole, it is the periphery of the root system that is most actively engaged in this work. The part near the base of the plant, where it emerges from the soil must contain all the transmitting portions of the whole root system; the bulk and weight of the roots collected here may, on this account alone, be the greatest. Added to this, attention has been drawn, in the Coimbatore work reviewed last month[1] to the fact that the older portions of the cane roots are not only bigger but of considerably greater specific gravity than the younger ones, a fact of significance when comparing the weights of oven dried roots.

Summing up, it is perfectly obvious that, in such a plant as the sugar cane, the mass of roots dug out is bound to be greater in the top 8 in.; but that considering its make up, it may very well turn out that the roots in somo other layer, say the second 8 in., are proportionally more actively engaged in the work of absorption. In other words, it is not safe to conclude that the bulk or weight of the roots in any layer is closely correlated with the amount of absorption taking place there; and until this matter has been further investigated, it strikes one that it is somewhat risky to make such generalizations and recommendations as the authors of this paper have indulged in. The writer has noted the great stress laid in the Coimbatore work on the constant replacement of roots by the formation of new ones; but this of course refers to irrigated canes; and it is doubtful how far it would hold in countries where there is no irrigation. For instance, it has been credibly stated that, in Antigua, cane roots have been met with 8 ft. down, in spite of the naturally heavy soil in that island. These roots must have been functioning for a very long time.

C.A.B.

JAMAICA LABOUR IN CUBA.—According to the *Times* the official protector of Jamaican labourers in Cuba lately arrived at Kingston in order to confer with the Government on the repatriation of a large number of them. Wages were so low on the Cuban sugar estates this season that labourers could barely subsist on them. Of the 75,000 British West Indians in Cuba about 60,000 are Jamaicans, and of this number some 35,0000 are labourers, the remainder being domestic servants.

U.S. BEET CROP.—According to Messrs. Willett & Gray, the area planted to beets this year in the United States amounts to 789,094 acres, against 703,846 acres planted and 651,661 acres finally harvested in 1928. As the 1928 crop produced 938,640 tons of sugar, it is expected that with a continuation of the present favourable weather conditions and good yields, the out-turn will amount to one million long tons. Some 82 factories will probably work.

1 "Studies of Sugar Cane Roots at different stages of growth." T. S. VENKATRAMAN and R. THOMAS. Memoirs of the Agricultural Department of India, Botanical Series, Vol. XVI, No. 5, January, 1929.

Sugar Cane Mosaic in Trinidad.

By F. STELL, Mycologist, Department of Agriculture, Trinidad, B.W.I.

It has been suggested that it might be of interest to your readers to know the mosaic situation in this Island ; also of the methods and results of control operations.

There are some 40,000 acres planted in sugar cane. Of these, approximately half are operated by estates, the remainder by cane farmers. These cane farmers are very numerous, a big majority of the holdings ranging from one to three acres. However, there are also a number of large farmers and there is a tendency to encourage this phase of planting. If this can be achieved, it will have a decided beneficial effect, in that supervision will be more economical and distinctly more effective.

Of the canes grown in the Colony only the Uba variety and its allies are known to be immune from mosaic. In recent years there has been a marked increase in the acreage planted with Uba on the estates, the reason for this being partly that this variety grows and ratoons well in comparatively poor soils. The standard canes in the Island are BH 10 (12) and B 156. Other varieties are grown in small amounts, including several Trinidad seedlings, though these last are still very largely in the experimental stage.

Mosaic disease was first recognised in Trinidad in 1920. The chief area of infestation was the Government Experiment Station and its vicinity. Several small centres of infection were subsequently located in the Island from cuttings sent out from the above Station. In all probability the original source of infection had been introduced some time previously in a consignment of imported "cuttings."

Following upon diagnosis, the Government organized a survey of the sugar estates and appointed a number of inspectors in the various districts to assist the farmers. Invested areas were systematically inspected and in the early years the small farmers were compensated for the stools destroyed and were supplied with healthy cuttings free of cost.

By this educational campaign the planters were taught to identify and handle the disease, and nowadays control work consists of inspection of areas and where necessary the issue of an order under the Plant Protection Ordinance.

The disease in Trinidad cannot be said to be serious. No doubt the limiting factor is the short ratooning period. Only rarely is a fourth ratoon grown. In general, replanting is necessary following the second or third ratoon because cropping becomes uneconomical after this stage. As is well-known, plant canes and first ratoons attacked with mosaic show foliage infection and this is correlated with some loss of sucrose ; but it is only in old ratoons that the disease becomes serious in that such canes are affected with stem canker, become very light in weight, and of little value in the factory.

The insect vector, *Aphis maidis*, has never been found in numbers in the Island. What one suspects to be the chief cause of spread is the planting of infected cuttings. Cuttinge from infected canes invariably reproduce the disease and in this way unlimited extension of the trouble can be encountered in new plantings and in fields which require "supplies." It is extremely difficult to control the operations of large numbers of small farmers, though the Government still employs Inspectors to assist in this work. Moreover, planters are reluctant to believe that mosaic is a serious potential menace to the crop because, as indicated above, plant canes especially do not appear to suffer appreciably. It is only when losses are sudden and severe that planters generally—with canes as with other crops—realize the gravity of pests and diseases.

Sugar Cane Mosaic in Trinidad.

As an instance of what can be done to control mosaic by adopting a vigorous and systematic roguing policy, the following data supplied by Mr. L. A. BRUNTON, Manager of the Government Experiment Station, may be of interest.

RESULT OF ROGUING MOSAIC DISEASE.

Systematic "roguing" for the control of mosaic disease was commenced in April, 1920 and has been continued regularly to the present date. During the first eight months four boys took two weeks to "rogue" the entire cultivation of 63·5 acres. The following six months three boys were found to be sufficient. Since then, i.e. from 1921 to 1927, two boys have been able to attend to an average acreage of 72 acres once a week, and for the past year (1928) the work has been efficiently performed over an area of 84 acres by one boy in a week. The incidence of infection is now so low that "roguing" once a fortnight with one boy will be sufficient to keep the disease in effective control.

The cost which at the start amounted to $2·70 an acre has now been reduced to 94c. and will be further reduced this year to half that amount.

The percentage of infection during the first four months, when "roguing" began in 1920, ranged from 39·5 per cent. in some fields of ratoon canes to 0·70 per cent. in plant canes.

The following return shows the percentage of infection each year from April 1920, from which date records for each variety in each field have been kept, the year being reckoned from June 1st of one year to May 31st of the next, except the first period 1920-21 which contains 14 months from April 1920 to May 1921.

RETURN OF MOSAIC INFECTION FROM 1920 TO 1928.

Year.	Acreage.	No. of Stools.	No. of infected stools.	Percentage of infection.
1920-1921	63·45	103,772	7,930	7·640
1921-1922	63·90	102,360	1,696	1·650
1922-1923	64·39	103,144	285	0·270
1923-1924	75·92	125,086	113	0·090
1924-1925	75·20	128,940	99	0·076
1925-1926	67·55	122,756	100	0·081
1926-1927	82·34	159,393	78	0·048
1927-1928	84·00	172,007	8	0·004

In conclusion it may be stated that the experience of Trinidad now bordering on a decade shows fairly clearly that if conscientious roguing measures are vigorously prosecuted and if only healthy cuttings are utilized as planting material, then the sugar cane industry should not be menaced by mosaic. It is the duty of estate proprietors and all others having charge of cane areas to insist that thorough roguing of fields should precede the selection of plants for extension and replanting. Fortunately, the Island is favoured by the fact that the disease was discovered before it became widespread; hence there is an abundance of healthy canes for planting purposes.

"CARBORAFFIN."—In a review of some work done by P. Honig and J. F. Bogtstra, which we recently published,[1] it was stated that figures for the amount of "Carboraffin" consumed in the trials in question were not stated. However, we are now asked to state that such information has been published,[2] and that the "Carboraffin" consumption in the trials reviewed amounted to 0·87 and 1·27 per thousand of Brix.

[1] *I.S.J.*, 1929, 375. [2] *Archief, Mededeelingen*, 1929, No. 5, 272.

The Present Status of the Sugar Industry in Cuba.

By EARL L. SYMES.

Nature's three weather variables, rain, sunshine and wind, are at present favouring the growing cane for the 1930 crop. Rain, the prime factor, however, has only lately come to the rescue of the withering stubble exposed to the blazing sun by the cane cutter's knife. The greatest drought in five years was experienced from January to the end of May. The following figures compiled and published by the Cuba Sugar Club will show that 1927 was almost as dry, but in that year there was much less left-over cane area being nursed along to produce another crop.

TOTAL RAINFALL, INCHES, FIVE MONTHS JANUARY TO MAY.

Year Normal	1925	1926	1927	1928	1929
14·95 ..	19·75 ..	17·57 ..	8·87 ..	14·06 ..	8·38

As will be noted the 1929 rainfall is only 56 per cent. of normal. The distribution over the various Provinces this year was as follows :—

Province	North Coast	South Coast
Pinar del Rio	11·04	
Havana	13·60	
Matanzas	8·26	
Santa Clara	8·96 ..	7·57
Camaguey	6·71 ..	6·54
Oriente	5·23 ..	8·38

This shows that the Eastern Provinces of Camaguey and Oriente had the lowest amount of rainfall during the harvest season, allowing greater speed in cane hauling, but causing incalculable damage to the left-over cane fields which were of course cut as quickly as possible. This Eastern section also had the greatest amount of cane uncut in 1928 due to the drastic restriction law. With practically no irrigation available it will be necessary to abandon much of this area owing to the low vitality of the dried out root systems of these left over cane plants. Altogether the long dry winter season may account for a 5 per cent. reduction in the 1930 crop. The high average yield of 12·40 per cent. obtained this year will hardly be equalled in the next crop. These two natural restrictive forces, in conjunction with the financial straits in which many sugar companies find themselves, may easily account for a 10 per cent. reduction in the next Cuban crop. Great emphasis should be placed on this probable natural curtailment of production, since rumours are beginning to be heard of renewed Government meddling with the normal development of the sugar industry. No greater calamity can be imagined than another year of crop restriction or sales control by Government regulations.

A little consideration of the development of the Cuban sugar industry will show that the present crop size is in accordance with the growth of sugar consumption in its principal market, the United States ; and not unreasonably ahead of the increase in world consumption. For this reason its expansion has not been artificially stimulated and no outside unnatural restrictive measures should be forced upon it, in an effort to bolster up its earnings. Such foreign forces only prolong the agony and postpone the day when it may again become a profitable business.

The average increase of sugar consumption in the United States over a period of 106 years has been at the rate of 5·11 per cent. annually. Data as to world consumption are not available over so long a period but it may average between 3 and 4 per cent. annual increase. Beginning with the crop of 1915 and calculating an annual increment of 5 per cent., the allowable production in 1929 would be 5,165,469 tons ; or slightly more than the amount actually produced in the past grinding season. The output in the

TABLE OF CUBAN CROP TONNAGES, PRICES, AND MILLS OPERATING.

Year	Long Tons (Sp. Wt.) of Sugar: Willett & Gray Statistics	Cuban Agriculture Final Crop Figures	Calculated on Basis of 5 per cent. annual increase in crop	N.Y. C & F Price	Mills Grinding
1915	2,592,667	2,608,914	2,608,914	3·62	177
1916	3,007,915	3,034,272	2,739,360	4·77	189
1917	3,023,720	3,054,997	2,876,328	5·21	199
1918	3,446,083	3,473,184	3,020,144	5·01	199
1919	3,971,776	4,009,734	3,171,151	6·35	198
1920	3,730,077	3,735,425	3,329,708	11·34	191
1921	3,936,040	3,934,297	3,496,193	3·46	198
1922	3,996,387	4,033,455	3,671,002	2·98	186
1923	3,602,910	3,645,967	3,854,552	5·24	182
1924	4,066,642	4,112,698	4,047,280	4·18	180
1925	5,125,970	5,189,346	4,249,644	2·56	183
1926	4,884,658	4,932,095	4,462,126	2·57	176
1927	4,508,521	4,508,600	4,685,232	2·96	177
1928	4,011,717	4,041,856	4,919,494	2·46	172
1929	5,156,315	5,156,410	5,165,469	1·75*	163

* Approximate price first six months of 1929.

year 1915 was probably unaffected by War demands, since the crop of 1913 was 2,428,537, and, of 1914, 2,597,732 long tons, showing only a gradual increase in 1915. Using the figure for 1913 and calculating on a basis of 4 per cent. annual increase the allowable production in the coming season of 1930 would be 4,730,155 which is somewhat higher than the probable production of 4,640,077 tons when a natural decrease of 10 per cent. is taken into consideration. This seems to indicate that the sugar production of Cuba has risen at a normal rate and the present glut of the market is due not so much to quantity as to quality ; too much Cuban raw sugar thrown on world markets which cannot absorb it. Some mill owners are beginning to see the light and there are reports that certain factories will produce some high grade turbinado sugar for direct consumption. At three factories the total sugar production the past season polarized over 99 and held less than 0·2 per cent. moisture. This was used for refinery supplies by HERSHEY. However some shipments were made for direct consumption.

In the table given above some slight difference is noted in the data from WILLETT & GRAY and the Cuban Department of Agriculture. This is mainly caused by the custom of assuming that all bags are filled to 320 Spanish pounds. Many mills fill to 345 pounds and some only to 310 pounds, depending on the size of bags used and also sometimes on the quality of cane being ground.

The Cuban department of Agriculture receives data from each factory specifying the number of bags of each weight filled, so that its final figures should be more nearly accurate than any arrived at by dividing total bags by seven to get the tonnage. Unless the total of 5,156,410 long tons Spanish weight is changed after all of these reports are in, the crop just finished is not a record crop for Cuba, as recently suggested in some periodicals, since the production of the 1925 crop is shown as 5,189,346 tons, about 33,000 greater.

It may be of interest to note that the Spanish pound used in Cuba is equal to 1·01438 pounds avoirdupois, so that the total Cuban 1929 production may be expressed in the different units as follows :—

5,156,410 tons of 2240 pounds Spanish weight
5,230,559 tons of 2240 pounds avoirdupois
5,314,489 tons metric weight
5,858,226 tons of 2000 pounds avoirdupois

The metric weight propagandists might secure some interesting material from a study of the many different systems used in the World's sugar industry.

Many reports are heard of mills that will be unable to operate in the coming grinding season, and while there is nothing definitely known as yet, it is quite probable that not more than 150 will be in a position to grind unless artificial governmental measures are adopted that will allow these high cost units to work. If these mills were allowed to drop out in a normal way, some of their lands would be available for the diversified crop programme that the Department of Agriculture is pushing, and more labourers could be found to work the new crops. The record crop of 1925 was taken off in 183 mills while only 163 were employed in the past season when that output was almost equalled. This elimination of 20 small units indicates an increased capacity in the remaining factories.

Of the 163 mills grinding in 1929, 42 produced less than 100,000 bags and of this number, 21 made less than 75,000 bags, so that a reduction in the number of operating factories to 150 should have little effect on the crop outturn, since many of the larger units have never ground to capacity. This is indicated by the production this year of 1,014,425 bags by Central Preston which had not exceeded the 600,000 bag mark during the past five years. This large crop was turned out in less than six months, which is in itself a record; although the production of Central Delicias in 1922 was 1,046,493 bags, more than eight months were required to reach that record. Many operating companies controlling several mills in one district are planning to close one or more of the smaller units, temporarily perhaps, and grind the cane in their larger more efficient factories. While the proportion of manufacturing cost does not usually exceed 40 per cent., this method of operation will make for substantial reductions in overhead costs, which may in some cases be extended to the cost of cane also.

As shown above, the average N.Y. c. & f. price for raw sugar during the first six months of 1929 was about 1·75 or say 1·62 f.o.b. Cuba. All cane was bought and paid for in this period on that average basis, and it is difficult to believe that any of the banks or mills have been able to liquidate in full their loans to cane planters to produce this cane. For this reason advances on the ratoons now being cultivated have been reduced and many fields are being abandoned. In the Western Provinces very few new plantings are being considered. Reports from the Eastern Provinces of Camaguey and Oriente indicate that the large mills there are making new plantings to the limit of their resources. This is probably being done on the chance that the demand for sugar will be better in 1931.

This speculative tendency to increase production may still be predominant in the Eastern Provinces, if this rumoured expansion in plantings turns out to be true. The following data will show how the output of sugar has decreased in the four Western Provinces of Pinar del Rio, Havana, Matanzas and Santa Clara in the past decade, while the total Island production has been on the increase.

PERCENTAGE OF TOTAL CUBAN CROP.

Produced	Year 1921	1922	1923	1924	1925	1926	1927	1928	1929
In West..	55·95..	43·94..	42·20..	45·30..	46·46..	41·47..	41·06..	39·45..	40·24
In East..	44·05..	56·06..	57·80..	54·70..	53·54..	58·53..	58·94..	60·55..	59·76

The percentages for 1919 and 1920 were practically the same as in 1921, being 55·49 and 54·79 per cent. for the Western Province. This shows that the Eastern Provinces have advanced from 44 per cent. to 60 per cent. in the past few years and that this was not gradual but characterized by an abrupt

break in the year 1922, when the production jumped from 44·05 per cent. in 1921 to 56·06 per cent. in 1922. This was no doubt due to the business depression which followed the collapse of prices in 1920. Apparently the small companies in the Western Provinces were hardest hit by this blow and have never really recovered.

This tendency will doubtless continue under present market conditions, and while it may not at first be recognized as a good thing for the country, it is a blessing in disguise. This transition of cane production to Camaguey and Oriente Provinces will bring diversified farming to the Western Provinces, allow the production of greater quantities of food, thus displacing such importations and gradually raise the standard of living among the country people who have been virtual slaves to cane. The Cuban Government has been encouraging the diversification of crops during the past few years and if it refrains from stimulating the cane planters with artificial measures this new agricultural policy will become firmly rooted, at least in the four Western Provinces.

Large quantities of rice seed were imported and distributed by Government agencies this spring and it is reported that over 100,000 acres are being dedicated to this crop at present. The Agriculture Department has inaugurated a nation-wide corn contest in which successful contestants may win valuable prizes at an exhibition to be held in the Autumn. Large sections of land in Matanzas and Havana Provinces are being put into potato crops this season, and parties of agricultural lecturers are touring the country giving popular talks on the various common crops that may be grown. Several old cane plantations have been planted to henequen in the past few years, from which great quantities of rope and binder twine are being made in a large cordage factory established near the city of Matanzas. The old Juragua section across the bay from Cienfuegos, formerly in cane and supporting a small mill, has been taken over completely by this fibre plantation.

A great stimulus to this impending change in the Western Provinces is the Central Highway now being pushed through the Island by the Government. The portion from Havana to Matanzas is completed and it is planned to have the new road finished to Santa Clara City sometime next year. About twelve thousand men are employed on this project continuously. This new year-round hard road communication with the principal cities of these Provinces will provide cheap transportation for many small crops heretofore not grown or marketed, owing to exhorbitant transportation costs. Construction is also progressing in the Eastern Provinces but their distance of some four hundred miles will probably not encourage much small crop production for the Havana market. However, this means of communication will allow produce to be brought in to the cane growers from the Western farming sections to displace food now imported.

• Many efforts are being directed to the reduction of costs in the Cuban sugar industry. Newspapers report that salaries have been reduced 30 to 50 per cent. by some companies ; it is not known whether this cut is extensive to the day labourer or not. This is an old time method of paring costs, and not countenanced in the modern economic philosophy of business, which allows nothing to interfere with the progress of consumer demand. The fact that 97 per cent. of the sugar production is exported does not change the status of these workers as consumers of industrial products. The larger percentage of cane sugar cost being in the cane itself should draw attention to the possibilities of cutting labour costs in that field, not by wage reductions, but by

the introduction of labour saving mechanical devices which will reduce the man-hours required to deliver a ton of cane to the factory.

Utilization of by-products is another fertile field for realizing on values now overlooked. It is estimated that the value of bagasse board produced in Louisiana in 1929 will be $22,800,000, and the value of the sugar and molasses crops will be less than $15,000,000. Apparently bagasse is a very high priced fuel and it might be better to burn the sugar. A new process is now being developed in Cuba known as the Vazcane Process; to grind the cane on carborundum rolls and produce a fine long-fibred building board from the bagasse. An experimental plant was operated in the past season and results seem to have been satisfactory. The Cuban Senate has recently passed an Alcohol Bill which is causing wide comment and severe criticism, due to the proposed levying of 1½d. tax on every gallon of molasses exported. It is doubtful whether this Bill will pass through the Lower House, since its consideration has been delayed until December which will give its opponents plenty of time to kill it or have the objectionable features changed. The molasses market has responded bravely with many 1930 contracts being signed at 7, 8, and in some cases 9 cents per gallon, being in some reports almost double the amounts received in 1929. As long as these prices prevail there is little chance of much expansion in the Cuban alcohol industry. During the first six months of this year the shipments of sugar have been as follows, as compared to recent years :—

EXPORTS OF CUBAN SUGARS, JANUARY TO JUNE 30TH.

To United States :—	1929	1928	1927
Raw	2,089,552	1,166,675	1,642,179
Refined	144,595	99,343	37,481
	2,234,147	1,266,018	1,679,660
Per cent. of Total Sugar Exports to U.S.	78	69	75
TO OTHER COUNTRIES :—			
Raw	600,804	568,610	536,536
Refined	966	2,280	8,310
	601,770	570,890	544,846
TOTAL SHIPMENTS	2,835,917	1,836,908	2,224,506
TOTAL CROP	5,156,410	4,018,386	4,508,376
PER CENT. OF TOTAL CROP SHIPPED	55	46	49

Due to extreme restriction in 1928 the comparisons are probably not so enlightening. However shipments are higher than usual and some authorities account for the great increase in shipments to the United States by a supposed increase in consumption. It is more than probable that the pending Tariff changes and low price, together with the necessary liquidation of colono sugars from a crop, which turned out to be a million tons greater than the previous one, are the causes for this increase in shipments to the United States. The exports to other countries do not show much growth and it is hoped that a closer working agreement between the New York Syndicate and the Cuban Export Corporation, or an actual merger of the two, may be brought about, so that the expansion of markets for Cuban sugars in other countries may go forward at a faster pace.

NEW COMPANY.—Albion Sugar Co., Ltd. (240,853).—Private. Nominal capital, £150,000. D. H. Whitelaw, 95, York Mansions, Battersea Park, S.W.11. (subscriber).

Zamaron's Method of Clarifying Molasses for Analytical Purposes.

By KAUSHAL K. BHARGAVA, B Sc., A.R.T.C. (Glas)

In ZAMARON's method the following two reagents are used : (1) Hypochlorite of lime : This is prepared by grinding 625 grms. of dry commercial bleaching powder with 1000 c.c. of water to a thin paste, and filtering the whole through an ordinary filter-paper. About 700 to 800 c.c. of the solution of about 18°Bé. are usually obtained. (2) Neutral lead-acetate : This is prepared by dissolving 300 grms. of lead acetate in water, neutralizing any free alkali or acid with acetic acid or sodium hydroxide, and making the whole to one litre.

Manipulation : 26 grms. of the molasses are diluted with water, transferred with rinsings to a 200 c.c. flask, and 25 or 30 c.c. or more of the hypochlorite solution are added drop by drop until the dark solution is well bleached ; 10 c.c. of the neutral lead acetate solution are then added, and the contents thoroughly mixed. As the temperature of the solution rises, it is cooled in flowing water to air temperature, and made up to the mark. The whole is then thoroughly mixed and filtered. The filtrate is read for direct polarization ; and 50 c.c. from it are inverted by HERZFELD's method for invert polarization. From these two observations, the percentage of sucrose in the sample is calculated.

According to ZAMARON, the process secures a good clarification, does not precipitate reducing sugars, and forms no objectionable lead-sugar compounds. PELLET and FRIBOURG[1] have also said that it is preferable to employ normal lead acetate solution for defecation in conjunction with the solution of bleaching powder. ZAMARON and GONGORA[2] have found that the polarization of the molasses solution treated with neutral lead acetate alone, was lower than that treated in conjunction with bleaching powder solution, and the difference increases with the amount of reducing sugars. Prof. ARTHUR E. LING, in his article on " Sugar Analysis " in THORPE's " Dictionary," remarks that insufficient work has been carried out to test the validity of ZAMARON's method, which *prima facie* does not seem one that could be recommended.

Apparently the chief defect of this method appeared to be the error caused by the large volume of the precipitate present when the solution is made up to 200 c.c. To eliminate this error, it was decided to use calcium hypochlorite as the decolorizing agent and neutral lead acetate as the precipitating agent, as has been suggested by ZAMARON, but instead of adding lead acetate in solution form as given above, to add anhydrous lead acetate after the solution has been made up to 200 c.c. (a modification according to HORNE's method).

As the result of a good many experiments, it was decided that 22·5 c.c. of the hypochlorite solution containing 7·4 per cent. of available chlorine, and 5 c.c. of neutral lead acetate solution can be taken as the minimum quantities of the reagents required for decolorizing 13 grms. of the particular molasses used in our experiments. To determine the error caused by the volume of the precipitate, 26 grms. of white granulated sugar of 99·79° polarization were dissolved in water, and treated with the above reagents. On adding lead acetate a white precipitate was first formed, which soon after turned into

1 *Bull. Assoc. Chem. Sucr. Dist.*, 1906, 23, 1128.
2 *Bull. Assoc. Chem. Sucr. Dist.*, 1907, 25, 127.

a brownish yellow colour. On shaking the flask and cooling, the brownish colour disappeared, leaving a yellow precipitate and a pale straw coloured liquid. The solution gave a very low polarization. Several experiments were repeated, all with similar results. When these solutions were left over night, they became darker in colour and were difficult to polarize.

Since the presence of the precipitate should increase the polarization instead of decreasing, it was concluded that some chemical change of the sucrose must have occurred, and probably it was inversion. This was confirmed when sugar solutions were treated with hypochlorite of lime alone, and similar results were obtained with chlorine water. The original purpose of the experiments was therefore abandoned, and experiments were undertaken to ascertain the reaction of chlorine water, hypochlorous acid, and sodium hypochlorite solution, on sugar solutions.

26 grms. of white granulated sugar were dissolved in water, treated with 20 c.c. of hypochlorous acid containing 7·4 per cent. of available chlorine, and made up to 100 c.c. When this solution was polarized after 24 hours, it gave a reading of 7·6°, and after a week of —31·2° Similar experiments were performed with chlorine water with almost the same results. In a typical experiment, 26 grms. of white sugar were dissolved in water and treated with some chlorine water containing 0·3 per cent. available chlorine. In the beginning the solution polarized 97·9°, but went on decreasing every day, giving after two weeks a polarization of —30°. The progress of the reaction was noted every day, and it was found that in the beginning the reaction in both cases goes on rapidly, and then becomes slower every day as the polarization becomes lower and lower.

To ascertain the nature of the reaction, the sugar solutions after treatment with chlorine water and hypochlorous acid were tested for fructose and glucose. PINOFF's fructose and calcium fructosates tests[1] definitely showed the presence of fructose in both cases. No definite results could be obtained for glucose, because the solutions contained chlorine, and all attempts to form glucosazones or di-glucosebenzidide resulted in a tarry mass, and no crystalline compounds could be obtained.

Therefore to prove the exact nature of the reaction some quantitative tests were undertaken, as follows : Two normal weights of white granulated sugar were dissolved in two separate flasks, treated with hypochlorous acid solution and chlorine water respectively, made up to 100 c.c., and left overnight. Next morning the amount of sucrose and invert sugar were estimated in these solutions simultaneously. For the estimation of invert sugars 5 c.c. of these solutions were neutralized with caustic soda, and diluted to 200 c.c. The invert sugars then were determined by titration with standard Fehling's solution. As in these solutions, sucrose cannot be estimated by polarization methods, because the solutions are changing in rotation to an appreciable extent, 50 c.c. of the original solution were inverted by HERZFELD's method, and made up to 100 c.c., 10 c.c. from this inverted and diluted solution were neutralized with caustic soda and diluted to 200 c.c. The total invert sugars were then determined as usual by titration with standard Fehling's solution. From the results the amounts of invert sugar, found by previous set of experiments, were deducted, and the amount of un-inverted sucrose present in the original solution could then be calculated. The following results were obtained :—

[1] *Ber.*, 38, 3317.

Solutions treated with	Sucrose per 100 c.c. of the original solution estimated as: Sucrose grms.	Invert Sugars grms.	Total Sucrose grms.
Hypochlorous acid	1·45	24·16	25·61
Chlorine water	0·66	24·67	25·33

Originally we started with 26 grms. of white granulated sugar of 99·79° polarization. It can therefore be concluded that both hypochlorous acid and chlorine water cause inversion in sucrose solutions.

As the bleaching action of sodium hypochlorite on molasses is almost the s me as that of calcium hypochlorite, the effect of this reagent on sugar solutions has also been examined. The reagent was prepared by adding an exact quantity of caustic soda to the hypochlorous acid, calculated on the amount of available chlorine. Normal weights of white sugar were dissolved in three different flasks, treated with 9 c.c., 22·5 c.c., and 45 c.c. of sodium hypochlorite solution, and made up to 100 c.c. On examining these solutions at different intervals of time the following results have been obtained :—

Time	Polarization of sugar solutions treated with different amounts of the reagent: 9 c.c.	22·5 c.c.	45 0 c.c.
10-30 a.m.	—	97·7	—
11-30 a.m.	—	98·4	—
12-30 a.m.	99·1	99·1	—
2 p.m.	99·7	99·9	—
3 p.m.	100·1	100·3	96·2
4 p.m.	100·2	100·5	98·7
5 p.m.	constant	constant	100·9
9-30 a.m. (next morning)	„	„	102·1
10-30 a.m. „ „	„	„	constant

These solutions were kept over for a week without any further change in polarization. No fructose could be traced in these solutions ; nor did these solutions become dark on concentration like those treated with other reagents.

Conclusions.—Experiments in which solutions of white granulated sugar were treated with calcium hypochlorite, chlorine water, and hypochlorous acid show that these reagents cause the inversion of sucrose. Hence they cannot be used for decolorizing sugar products for polarimetric purposes, as suggested by Zamaron and others. Sodium hypochlorite, however, has no such effect ; but this reagent likewise alters the polarization of sucrose solutions to a small extent, and therefore also cannot be recommended for use with sugar products for analytical purposes, without further investigation.

The writer desires to express his gratitude to Mr. T. H. P. Heriot, F.I.C., for his valuable suggestions and kind guidance in carrying out this work.

Dr. de Vecchis.—Dr. Ineo de Vecchis is reported to have taken proceedings in the English Courts to prevent the transfer of the De Vecchis patents by De Vecchis (Foreign and Colonial), Ltd., to the Sugar Beet and Crop Driers, Ltd., recently announced. Dr. de Vecchis, who is substantially interested in the sale of the patents, states that he was not consulted by De Vecchis (Foreign and Colonial), Ltd., prior to the agreement with the Sugar Beet and Crop Driers, Ltd., and disapproves very strongly of the terms upon which the sale is said to have been made.

Dried Beet Pulp.—S. T. Johnson, of the Norfolk Agricultural Station, Sprowston, Norwich, recently conducted experiments proving dried sugar beet pulp to be a cheap substitute for swedes or mangels as part of the ration of fattening bullocks. Animals fed on it have fattened quite as fast as those on roots, and have yielded carcasses equally good in respect both of proportion to live weight and quality of meat. His communication is a useful one to those interested in this phase of beet agriculture.[1]

[1] *Occasional Notes, Royal Agricultural Society of England.*

Beet Technical Notes.

Use of Soda in Excess.—In a recent article[1] the well-known Dr. H. Claassen, of Dormagen, Germany, expresses a warning against the use of excessive doses of soda for the transformation of the lime present into the corresponding soda salts. In a certain factory working more than two million metric quintals (200,000 metric tons) of roots, 0·2 per cent, of soda calculated on the weight of roots sliced was added to entirely eliminate the lime present, which was 0·04 per cent., sulphitation being applied at the same time to lighten the colour of the juices as much as possible. This factory had it worked in this way throughout the campaign would have employed 4000 quintals of soda, thus precipitating 1000 q. of combined lime. As two parts of soda are theoretically necessary for precipitating one of lime, the factory must have used 2000 q. of soda in excess, this remaining in the juice partly as such, and partly in the form of sulphites. But the unutilized soda naturally would act in the juice as a non-sugar, and one part of it would exert the effect of rendering at least 1·7 parts of sugar uncrystallizable.

Assuming the melassigenic figure of 1·7, the result of adding this soda would be as follows: 2000 q. of soda in excess would render 3400 q. of sugar uncrystallizable, equivalent to 3540 q. of 96° sugar at 32 marks, or a value of 113,280 marks. Deducting 6800 q. of additional molasses at 9 marks, worth 61,200, one obtains a figure of 52,080 marks, to which is added the cost of 4000 q. of soda at 14 marks = 56,000 marks, giving a total loss of 108,080 marks. However, there is an advantage in using this excess of soda, namely that the evaporators do not require cleaning so frequently, an advantage which may be figured as equivalent to 10,000 marks. This deducted from the above loss of 108,080 marks, leaves a loss of nearly 100,000 marks for this factory. This transformation of the lime salts into soda salts does not procure any other advantage than the diminution of the incrustations in the evaporators. Operating rationally, juices containing readily soluble lime salts can be worked as well as those which have been de-calcified. In fact, the crystallization of the sugar from syrups containing lime salts is better than from those containing soda, and a lower purity molasses is obtained. Some claim as an advantage of juices which have been delimed with an excess of soda the fact that the juices can be strongly sulphited, giving a good decolorization. But this decolorization surely does not compensate for the high cost of complete de-calcification and in addition the cost of large amounts of sulphurous acid. In any case it would be worth investigating whether the simple treatment of the syrups with sulphurous acid, and eventually also with decolorizing carbon, would not cost less and give an equally good sugar. However, one sees, concludes Dr. Claassen, from all this that any change in manufacture is to be considered pencil-in-hand, and its effects on the whole of the work studied, in particular on the nature and composition of the molasses.

Oxford Process.—Mr. E. Saillard, Director of the Laboratory of the Syndicate of Sugar Manufacturers of France, has twice again visited Eynsham factory, namely in February and June of this year; and now he has written a lengthy report of his experiences.[2] He gives particulars of the new plant. There are two dryers, each of 120 tons of roots per day, of the same type as before. The consumption of coal in these dryers, having a calorific value of 7200-7400 cal., is from 154 to 176 lbs. per metric ton of fresh cossettes, the cost of this fuel being 18s. to 20s. per long ton. Reducing sugars were present in the dried cossettes, even when they had not been affected by the frost. One

[1] *Centr. Zuckerind.*, 1929, 37, No. 15, 413-414.
[2] *Suppl. Circ. hebd.*, Nos. 2099 and 2100 of 1929.

obtains 25 kg. of dried cossettes per 100 kg. of fresh cossettes; and the dried cossettes weigh 250 to 300 kg. per cub. metre; hence one metre of storage space is required per ton of roots worked. However, it should be possible to compress the dried cossettes before storage, and if this were done it is estimated that 60 cub. ft. would be required for one ton, or 0·5 cub. m. per ton of fresh cossettes. The store measures 120 ft. × 120 ft. × 30 ft., and can take 4000 tons of dried cossettes. Cossettes, white and more or less brittle, according to their water content, were obtained. Capacity of the factory: 250 quintals of dried cossettes per day.

In regard to the extraction plant, there are two diffusion batteries, each 3½ ft. diam. and 5½ ft. high of 9·5 to 10 hectolitres capacity. Diffusion is carried out as usual. About 50 gallons of juice are drawn off each diffuser, that is 113 litres of juice per 100 kg. of dried cossettes; 100 kg. of dried cossettes give 225 kg. of exhausted cossettes containing 88 per cent of water, and about 200 litres of waste water. It was found that the dried cossettes being worked had a sugar content of only 62-65 per cent. and about 1 per cent. of reducing sugars; the Brix of the diffusion juice was 35-43°; it had a purity of 90°, and contained 1 per cent. of reducing sugars. Losses of sugar in the exhausted cossettes were higher than in ordinary working. "Without doubt experiments have yet to be made to establish the design of the best diffusion battery for dried cossettes ...... I do not think that the two new batteries installed at Eynsham for the 1928-29 campaign can give under the best conditions the desired results, viz., diffusion juice of at least 45° Brix and 40·5 per cent. of sugar by weight, whilst leaving in the exhaust cossettes only 0·15 to 0·25 of sugar per 100 kg. of fresh cossettes." These losses, however, are not to be attributed to the Oxford process, the installation and operation of the diffusion having yet to be improved. After de-pulping, the diffusion juice (or rather syrup) is heated to 80° C., and limed to a *pH* of about 7·5, using about 1 per cent. of milk-of-lime at 35° Brix, or 19·1° Bé., being then passed through Laval centrifuges, of which there are four, two being used at a time. A black viscous deposit is separated, containing 20 per cent. of sugar. It is calculated that the loss of sugar at the centrifuges amounts to 0·275 per cent. of the dried cossettes, that is about the same as in ordinary work when the washed cake contains 0·5 to 0·7 per cent. of sugar. The juice leaving the centrifuges contains reducing sugars, "as do all the products of the factory."

Coal Consumption.—In France very complete comparative data are published annually regarding the sugar industry of that country, its statistics, its plant, its process of manufacture, its results and the like.[1] Such complete figures are of a great value for estimating the progress made from year to year, and it is to be regretted that other countries do not follow this good example, thus permitting of a more general comparison of results. It is of much interest, for example, to observe the returns which have been made for the fuel consumption of the French factories since pre-war campaigns. In 1912-13 the coal burnt per metric ton of roots sliced was 117 kg. This increasing during the war, and after it in the following way: 1915-16, 130 kg.; and 1918-19, 145 kg. Then on the gradual return to more normal conditions it fell, viz., 1920-21, 139 kg.; 1922-23, 114 kg.; 1925-26, 109 kg.; and 1927-28, 101 kg., thus reaching a figure lower than before the war. Regarding the price paid for the coal, this in 1912-13 was 25·2 fr. per metric ton, but now it is in the neighbourhood of 152 fr. per metric ton. Such an increase (calculated on the gold basis) has naturally caused sugar manufacturers to exert every effort to cut

[1] *Bulletin de Statistique et de Législation comparée*; as recently reported in the *Journal des Fabricants de Sucre de France.*

expenses in this direction. According to results obtained notably in Czecho-Slovakia and in Germany it should be possible yet further to reduce the coal consumption by the improved system of evaporation under pressure, by heating with juice vapours, and by producing the steam under the most economical conditions. Mr. PÉRARD, Professor at the École Centrale, in a paper[1] describing the plant of the large modern sucrerie at Eppeville-Ham (Somme) France, expressed the opinion that one can look forward to a consumption of about 60 kg. of coal per ton of roots sliced, whilst Mr. DURET, the engineer of the Eppeville factory, estimated that it should be possible to lower the figure to 50-55 kg. In fact such low consumptions have been reached in the case of single factories here and there. It is reported, for example, that the Vyskov factory in Czecho-Slovakia has an average consumption of 44·7 kg., and that a factory in Italy has one of 56 kg. of Cardiff coal per ton of roots sliced.

Press-Cake Washing.—The Society of the German Sugar Industry recently awarded a prize to a paper written by Dr. FRANZ KERCHER, assistant manager at the Friedensau s. f.[2] This paper, which bore the title, "How much Water is necessary for Washing in the Scum-Presses in order to sweeten-off the Scum as far as possible ?" gives the results of a research carried out on the most thorough lines. Though nothing revolutionary results from the experiments described, yet the contribution may well serve as a model of how a technical paper should be composed. Since filter-press scum contains about 50 per cent. of juice, theoretically only 50 per cent. of water is necessary for its displacement. In practice, however, much more is required. Thus, Dr. ZSCHEYE has found 150-200 per cent. of water (on the weight of the scum) to sweeten off to about 1 per cent. ; whilst Dr. CLAASSEN in his well-known book gives 100-150 per cent. for reduction to 0·5 to 1·0 per cent ; and Dr. WOHRYZEK also states 100 per cent. There appears, therefore, to be agreement that in normal work at least 100 per cent. of water is required. In the experiments carried out by the writer to decide this question, one certainly not without bearing on general factory efficiency, Kroog filter-presses were used. Scum collected in these contained an average of 7·6 per cent. of sugar before washing, and this was washed down with hot water ; in another series of tests with cold water, both these experiments were carried out at two different water pressures. Using water at 64° C. and at a pressure of 2 atmos., the sugar contents of the cake after passing 400, 600, 800 and 1000 litres of water were reduced to 4·05, 1·44, 0·70, and 0·23 per cent. When the water pressure was 4 atmos., the respective figures for the same weight of cake were 4·56, 2·26, 1·14 and 0·60 per cent. These results show in the first place that the extent of sweetening-off is not proportional to the amount of water sent through the presses. Actually it would seem that two operations take place : (1) simple displacement of the juice by water, and (2) diffusion into the wash-water, this latter mostly taking place towards the end of sweetening-off. Using cold water (at 25° C.), the figures at 2 atmos. pressure for 400, 600 and 800 litres were 3·20, 1·00, 0·46 per cent. ; and at 4 atmos., 3·83, 2·03 and 1·08 per cent. It follows therefore that cold water is more effective than hot for washing out the sugar, besides which it is likely to dissolve less non-sugar, and also will decompose any trisaccharate which may be present. Another result noted is that it is best to wash out at as low a pressure as one reasonably can, in other words to prolong the duration of washing as much as is

1 *Bulletin de la Société des ingénieurs civils*, July-August, 1928.
2 *Centr. Zuckerind.*, 1929, 597-601.

practicable. In addition to these factors, the author considered the bearing of previous work in the factory. That the efficiency of the clarification has an effect on the nature of the press-cake goes without saying, badly carbonatated or over-carbonatated juices giving cakes that are difficultly washable. An observation made by this writer is that by shortening the duration of diffusion the scums are considerably improved, due to their content in coagulable substances difficult to wash being lowered. In fact, it was noted that by diminishing the time of diffusion it was possible to cut down the water used for washing by about 23 per cent. Taking advantage of these facts, it was finally possible for the author to reduce the sugar content to 0·5 to 1·0 per cent. by means of 80 per cent. of wash-water; that is a distinct improvement over the amounts stated necessary by various experts in the literature of this phase of beet sugar practice.

Miscellaneous Notes.—O. EISENER[1] points out that increasing importance is being attached in Germany to the drying of beet tops for fodder, a matter of much economical interest to the beet industry. At present in that country there are 50 such plants, dealing with only 2 per cent. of the production, whereas one should strive to reach about 50 per cent. With this object in view, an organization has been established for providing the necessary technical information, its name being : Die Zentrale für Trockungs-Industrie, of Berlin W 35. It is here mentioned that in Germany a morgan yields 50 dz. of tops yielding about 8 dz. of dried material, the value of which is about 15 marks per dz. ; the cost of drying this quantity being 50 marks, one obtains a figure of 120 less 50 equal to 70 marks, as representing the gross gain per morgan. equal to 1 to 1·2 marks per dz. of harvested roots. The cost of the plant would be between 2 and 3 marks per dz. of annual capacity ; whilst the cost of operating is 40-50 marks per zentner of raw goods.

Dr. H. A. SCHLOSSER and M. HRABOWSKI[2] in a long paper on "Final Saturation and Boiling-up" say that the following three processes give equally good results in respect of the elimination of the lime salts, always provided that the final carbonatation is carried through according to its optimum alkalinity.[3] In practical work the best method is to sulphur the thin-juice in a third saturation, and for the regulation of this end-point the optimum alkalinity should be determined by means of H.I.C. measurements, which should be within the range of 9·5 to 10·5 *pH*. By carefully maintaining this limit the heating surface of the evaporators can be kept free of lime deposits without the final boiling up of the thin-jiuce. Often high lime salts in the juice can be traced simply to the return of the sweet-waters from the presses. Such should be used for the low-grade sugars.

ROBERT J. BROWN, Research Chemist, Great Western Sugar Co., Denver, Colo., U.S.A.. in an article entitled "The Laboratory looks at the Mill" says[4] in regard to the elimination of colloids in carbonatation : "The effect of alkalinity on the amount of colloidal matter in juice is shown very clearly in first press sweet-water. As the concentration of the sweet-water decreases, the alkalinity likewise decreases and the lime salts with accompanying colloidal matter, increase. On returning the sweet-water to first carbonatation these impurities are reprecipitated as a result of the high alkalinity. On this basis it appears that the proper procedure to obtain juice lowest in colloidal matter consists in maintaining the maximum first carbonatation alkalinity

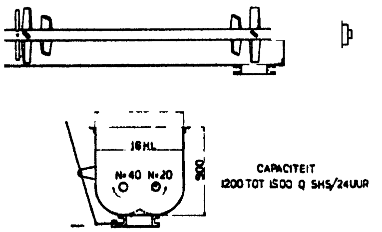
1 *Die deut. Zuckerind.*, 1929, 54, No. 20, 498.
2 *Centr. Zuckerind.*, 1929. 37, 463-466, 494, 497.
3 *I.S.J.*, 1929, 383.
4 *Sugar Press*, 1929, 13, No. 4, 14.

possible and returning sweet-water to first carbonatation at the earliest moment compatible with filtration capacity. Lime salts and the colloidal matter are not identical. Lime salts may be removed by precipitation with soda ash, and a fair portion of the colloidal matter is precipitated along with the calcium carbonate. Colloidal matter may be removed through treatment with activated carbon."

Java Technical Notes.

WHITE SUGAR PRODUCTION IN CANE SUGAR FACTORIES. **P. Honig.** *Archief*, 1929, 37, I, No. 4, 113-128.

This is a further article on methods of improving Java whites[1]. It is premised that the first demand which must be fulfilled in white sugar manufacture is the uniformity of the quality of the raw material, that is, evaporator syrup (here called "thick-juice," in the nomenclature of the beet sugar factory), and the second that it should be of such a composition that little non-sugar crystallizes out with the sucrose. Regarding the second demand, be it noted that even when using purified re-melts small quantities of non-sugars, including colouring matters, are occluded in the interior of the crystal. But the aspect of white sugar is strongly influenced by the small quantities of colouring in the syrup film which surrounds the crystal, much more so than by the interior colouring. Hence, the importance of properly washing the sugar. A sugar having a colour-value of 0·070 (at 509 $m\mu$) is to be regarded as a bad one when the colouring surrounds the crystal, but as quite a moderate one when this same amount is included in it. Present methods of subsiding the evaporator syrups, or filtering them, are hardly effective at all for their purification. Due to their high costs, syrup filtration by the Bach process, paper-pulp, or kieselguhr, is prohibitive. Results with sand filtration are not yet established, nor is centrifugal clarification sufficiently advanced. At present the best that can be advised is to take care that the quality of the syrup is the best possible by carrying out the clarification of the juice in the most conscientious way. Drawing off the clear juice must be done most carefully, and in order to increase the physical effect of the calcium sulphite precipitate in sulphitation one should not attempt to save lime by adding to the point at which a clear defecation is just obtained, but rather one should add some in addition to this. Besides good evaporator syrup, the products which can be used for the graining of superior white sugar are the green *A*-syrup, wash-syrups, and the re-melted *C* and *D* sugars. Normally the purity of the *B* and *C* syrups are such that the sugars obtained on crystallizing them contain more then 0·15 per cent. of non-sugars. Boiling methods in which molasses sugars are used as *pied-de-cuite* for the first massecuite cannot be recommended for making good white sugar, in the first place because the colour and purity of such a molasses is far from ideal, and further because the



[1] *I.S.J.*, 1929, 373.

regularity of the grain is in most cases insufficient for a satisfactory final product. Sugars which are re-melted must be carefully filtered, preferably using kieselguhr. Returning to the important matter of thoroughly washing the white crystals obtained, the pre-dried crystals obtained in the double curing process should be pugged with clear syrup in an apparatus (such as is here illustrated) in which an intensive mixing takes place, and the time taken to do this should be at least 10 minutes, whilst the temperature of this synthetic massecuite should be about 45° C. In general in white sugar manufacture the most careful control throughout is necessary, and this should be in the hands of the *fabricage-chef* and two factory chemists.

CLARIFICATION OF CONCENTRATED SUGAR LIQUORS. **P. Honig and J. F. Bogtstra.** *Archief, deel III, mededeelingen*, 1929, No. 11, 681-713.

In this monograph, consisting of three chapters, a survey is given of different processes which may be applied to the evaporator syrup for the improvement of Java white sugars. Subsiding is of no use; some process or processes involving filtration are necessary, the objects in view being to remove both mechanical impurities and colouring substances as far as possible, and also to eliminate constituents which on crystallization may lead to conglomerate formation or cause other detrimental effect. Bach's process, at present applied in eight factories in Java, is said to have the disadvantages of a difficult *modus operandi*, of a rather costly operation, and of failing to supply a better syrup than can be obtained in the carbonatation factory. Adsorption carbons are stated to be suitable more for re-melted sugar liquors than for evaporator syrups. In regard to purely physical methods, filtration over *doek* (the fibre of the Aren palm), or better *crin végétal*, formerly applied and abandoned as economically unsuitable, may again become of interest, use being made of cylindrical filters (1 metre diam. and 2 m. high) containing the medium between two perforated sheets of metal with the juice passing up from below. SAX has given an account of such filtration, the loss having been 0·2 per cent, of the sugar entering the process.[1] *Doek* fibre has the advantage of being very fine and of taking up very little liquid. Paper pulp filtration, using the Perrin filter, as reported on by HAZEWINKEL in 1909, is another possibility which may be revived. Likewise sand filters, employing types at present in use in the European beet industry (such as the "Perfect" filter) may now prove to be economical. Tests are described on the use of kieselguhr ("Hyflo-supercel") for syrup filtration, regarding which it is remarked that "the general impression we have obtained is that by filtering the thick-juice of a sulphitation factory with kieselguhr the effect does not compensate sufficiently for the rather considerable costs." "Centrifuging evaporator syrup is considered undoubtedly to have a future," but it is suggested that the Laval supercentrifuge, as used in some recent tests in Java[2] should be modified, mainly in the direction of shutting air out of the apparatus, making it of acid-resisting material, and rendering it more easily cleaned. In Chapter II the clarification of re-melted sugar liquors is considered in connexion with the refining of sugars on the plantation. Good results can be obtained with the carbonatation process, as in fact is being done with raws from Cuba, Peru, and Java at the Vlaardingen and Gorkum beet sugar factories, Holland, at the Westerrsuiker Raffinaderij, in Amsterdam, at the Tirlemont refinery in Belgium, and elsewhere.[3] According to this process, the well-affined sugar (99° purity) is re-melted to 50° Brix, treated with 0·4 to 0·7 per cent. (of the

1 *De Suikercongres*, 1901, 109. 2 *I.S.J.*, 1929, 392.

3 Similar methods are being applied in some of the beet sugar factories in England which refine raw cane sugars during the inter-campaign.

Brix) of lime, and with washed flue-gases from the boiler-house, the final reaction being neutral to pale-pink to phenolphthalein test-paper: filtration is carried out with ordinary presses or Sweetlands; the filtered liquor adjusted to 7·0 *pH* by continuous sulphitation, and again finally passed through low-pressure filters. Following this, it is boiled to white crystal sugar. A special advantage of this thorough clarification is a low lime content, which is not always achieved with the use of purely mechanical filtration or with carbon. Lime salts affect the appearance of the sugar crystal, and should not exceed 0·03 per cent. Calcium phosphate (using lime and phosphoric acid) also gives a good purification, as has already been pointed out in recent tests with decolorizing carbons.[1] In 1924 at the Phoenix s.f., Copenhagen, Denmark, precipitated calcium carbonate was added for the clarification of remelted sugar liquors, using 1·8 per cent., and obtaining an absolutely bright filtrate with a rate of filtration of 0·8 hectol. per sq. metre per hour. In Chapter III are described some experiments made at the Somobito carbonatation factory, Java, in September, 1928, in which a mixture of evaporator syrup, affination syrup, and re-melted fourth sugar was very readily filtered with the aid of 1·9 per cent. of "Hyflo-supercel" (on the Brix solids) using Kroog filters, the rate of filtration being 3·3 hl. per sq. m. per hour, a very good quality of consumption sugar being boiled from the clear filtrate. Lastly, it is pointed out that in Java the washing of the pre-dried sugars in the double-cutting process is generally insufficient. It is very important that the crystals should remain in contact with the wash-liquor for a much longer time than occurs at present, and further that the quality of the washing liquor should be improved. Such points have no small effect on the appearance of the white sugar obtained.

USE OF "CARBORAFFIN" IN THE SUGAR INDUSTRY. **Dr. E. Zappelli.** *Communicated to this Journal.*

"In the article by Dr P. HONIG and Mr. J. F. BOGTSTRA,[2] after an introduction on the subject of decolorizing carbons in general, a description is given of the tests carried out in Java in former years with "Norit" carbon and following that a detailed account is given of the "Carboraffin" tests made by myself in the Somobito factory in 1928 on behalf of the Carbo-Union, Frankfort a. M. The report furthermore states, that through the use of the small quantities of Carboraffin employed (averaging 0·1 per cent. of sugar in the solution) an average 50 per cent. decolorization of the liquor was obtained. The sugars obtained from the liquors bleached with "Carboraffin" are described in the report as very good. The authors furthermore report that the colour of the sugar produced from pre-filtered liquor, not bleached by Carboraffin, was, after careful washing out, also to be described as good; from which may be inferred, that this sugar without the so-called "washing out" had not so good an appearance as the sugar made from the liquor decolorized by Carboraffin. As regards the washing out, the authors give the following method of working: 300 grms. sugar are mashed with 630 c.c. colourless sugar solution of 70° Brix, and $pH = 6{\cdot}5$. After shaking for five hours, the massecuite is spun in a laboratory centrifugal. The appearance of the sugar coincided with that of the sugar obtained from the decolorized liquor. The colour measurement showed that the colouring matter had disappeared to a very great extent. To this I would make the following remarks: The improvement of the sugar by treating it with colourless sugar solution applies to any sugar. If the authors had treated the sugar obtained from the "Carboraffin" liquor in the same manner, they would have obtained

[1] *I.S.J.*, 1929, 374. [2] *I.S.J.*, 1929, 374.

a still better sugar. Failing a sample of similar Java sugar, I carried out this test again with Brazilian cane sugar, having a polarization of 93·8, and a colour of 2·5°St. From this sugar I prepared a liquor of 70°Brix and a *pH* value of 6·5, and completely decolorized it with "Carboraffin." Its purity amounted to 94·5. I stirred 300 grms. of the sugar with 360 c.cm. of the colourless liquor in a closed vessel provided with a stirring device, for periods of three hours, five hours and 15 hours at an ordinary temperature, the number of revolutions of the stirrer per min. being 17. After treatment during the periods of time above mentioned, the massecuite was spun in a laboratory hand-driven centrifugal with a bronze gauze having about 1300 meshes per sq. cm. The following table shows the figures obtained :—

Duration of treatment.	Gain in crystals.	Polarization of the refined sugar.	Purity quotient of the affination run-off.
3 hours	5·6 per cent.	97·9	88·3
5 „	8·8 „	98·15	86·2
15 „	17·8 „	99·1	85·3

It is thus evident that treatment with colourless liquor under these conditions produced an increase of crystals which further increased with the duration of the treatment. An increase of the polarization of the refined sugar produced also took place with a corresponding lowering of the purity quotients of the resultant outflow. The colour of the sugar fell from 2·50 to 0·67° St. after three hours. The results signify that the several hours' treatment of a sugar with colourless liquor is not a true washing-out of the crystals. On the contrary, the purification of the crystals is caused by an osmotic process together with growth of crystals. However, I would further point out that the carrying out of such a refining process in a factory requires a washing apparatus and enlarged centrifugal plant. Furthermore, for this treatment a decolorized liquor must be produced, the quantity of which liquor is comparatively large, seeing that for one part of sugar, 1·2 parts of sugar must be dissolved. This liquor must be completely decolorized in a special apparatus, this necessitating the use of considerable quantities of carbon. I therefore believe that to carry out the authors' laboratory tests on a commercial scale would prove in practice more costly and more tedious than the decolorization of the pre-filtered liquor, as I did it."

FINAL FIGURES FOR THE 1928 FACTORY CONTROL. **C. Sylmans.** *Archief*, 1929, *Medeedelingen No.* 3.

This communication consists of some 65 pages of figures collecting the results of the Java sugar factories for the 1928 crop, so that it is hardly possible to do more than give summaries of the most important of the very numerous data. During the period under review, there were 60 defecation, 74 sulphitation and 42 carbonatation factories in operation, the numbers for 1927 having been, 62, 71 and 38, and for 1926, 65, 70 and 33. There were five factories recording a molasses purity less than 31 (that is, sucrose purity), their figures being 30·7, 29·8, 29·2, 29·2 and 29·0°. On the other hand, 18 returned molasses purities higher than 37, these ranging from 37·1 to 39·6. A list is given (with the names) of factories having high unknown losses, and 12 had a higher value than 40 for the "unknown crystal loss per 100 of polarization in the raw juice." Here are some figures taken from the Java control sheets for the past five years, which are of interest as showing some of the values adopted in that country for comparing the work of the factories :—

Year	Pol. purity. Raw juice.	Pol. purity. Thin juice.	Juice purifying effect.	Molasses sucrose purity.	Technical results. Pol. press cake per cent. non-sugars raw juice.	Technical results. Sucrose total molasses per cent. non-sugars raw juice.	Technical results. Unknown losses per cent. pol. raw juice.	Technical results. Winter's rendement.	Effective results. Pol. lost per cent. pol. cane. In Manufacture.	Effective results. Pol. lost per cent. pol. cane. Bagasse.
1924	83·2	84·7	10·5	34·1	3·0	44·3	2·1	97·2	9·4	7·1
1925	84·0	85·4	10·2	34·5	2·6	45·1	2·0	97·3	9·0	6·2
1926	80·9	82·3	8·9	34·0	2·3	44·5	2·2	97·2	10·9	6·1
1927	83·3	84·8	10·6	33·6	2·9	41·6	2·0	98·0	8·9	5·6
1928	84·3	85·7	12·3	34·4	3·4	43·0	2·0	97·6	8·8	5·4

Hence in 1928 a "technical result" inferior to the figures of the previous year was obtained, the consequence of a greater loss of sucrose in the molasses, especially in the sulphitation factories. The greater loss of sugar in the filter-press cake is partly the result of a greater quantity of cake per 100 of cane, more lime having been used, and is partly due to the higher sugar content of the cake. In 1928 the litres of milk-of-lime of 15°Bé. per 1000 litres of juice were as follows : defecation, raw juice, 3·8, muddy juice, 9·6 ; sulphitation, raw juice, 10·6, muddy juice, 11·6 ; whilst the total for carbonatation was 99·2 litres, a distinct increase on the volumes used in 1926. Notwithstanding the greater rate of crushing and higher rendement the quality of the sugars in 1928 was better than in previous years. In conclusion some capacity figures per 1000 quintals of cane (100 metric tons) are given from 1928 and 1921, comparison of which with those of other countries is worth making.

	Filters, sq. m. of surface. 1921	Filters, sq. m. of surface. 1928	Evaporators, sq. m. of h. s. 1921	Evaporators, sq. m. of h. s. 1928	Pans, capacity in h. l. 1921	Pans, capacity in h. l. 1928	Pans, sq. m. of h. s. 1921	Pans, sq. m. of h. s. 1928
Defecation	32	33	117	120	76	79	30	31
Sulphitation	34	34	130	134	87	86	41	38
Carbonatation	34	32	141	132	86	89	36	36

	Crystallizers, capacity in h. l. 1921	Crystallizers, capacity in h. l. 1928	Centrifugals, 30 in. × 18 in. 1921	Centrifugals, 30 in. × 18 in. 1928	Molasses pre-dryers, 30 in. × 18 in. 1921	Molasses pre-dryers, 30 in. × 18 in. 1928
Defecation	164	170	2·38	2·55	1·17	1·37
Sulphitation	172	172	4·10	3·90	1·20	1·21
Carbonatation	181	186	4·10	3·90	1·04	1·19

EFFECT OF FEED ROLLERS ON THE WORK OF THE MILLING INSTALLATION.

L. D. Teutelink. *Archief*, 1929, I, 37, No. 19, 497-499.

An attempt was made to obtain from the Mutual Control figures by comparison of the lost juice value an insight into the possible bearing of the feed roller on the work of the milling installation, and in so doing a great number of data was collected so as to eliminate so far as possible the effect of variations of the sizes of the rollers. Thus for the seasons 1927 and 1928, figures were compared for the lost juice per cent. fibre, for the capacity of the mills, as well as for the maceration per cent. fibre, this being done as said for a good number of installations with and without feed rollers. But these figures failed to lead to any definite conclusions in regard to an improved extraction. A more definite conclusion, however, was afforded by the collection of the figures shown in the following table, from which the writer draws these conclusions : (1) So far as the lost juice per cent. fibre is concerned, no

more favourable result is shown in the case of installations provided with feed rollers than those without such additions. (2) On the other hand, the figures show that higher capacities are obtained by means of the installations provided with feed-rollers with greater thicknesses of the bagasse layer, coupled with a higher pressure in the mill openings. It would appear therefore that the value of the feed rollers lies principally in obtaining a more regular operation of the mills with increased capacity, demanding less care from the personnel, and not in any appreciably increased juice extraction.

Season	Cane Capacity in 24 hours, quintals	Fibre, kg. per litre, through the rear opening.				Fibre, grms. per sq. dm. of roller surface per 30 in. roll diameter.				Number of examples	Feed rollers.
		I	II	III	IV	I	II	III	IV		
1928	10442	0·54	0·66	0·71	0·76	110	115	139	138	6	4
1927	9045	0·51	0·68	0·66	0·61	106	110	128	116	6	0
1928	9947	0·53	0·68	0·80	0·88	115	133	147	151	16	4
1926	8315	0·51	0·62	0·72	0·79	106	119	128	120	16	0
1928	9706	0·55	0·72	0·84	0·94	112	129	143	145	22	4
1925	8367	0·53	0·67	0·77	0·81	112	121	131	126	22	0

Mills Rolls and Re-Shelling.[1]

M. J. GALAINENA, M E.

Mill Rolls.

The life of a mill roll shell depends on various factors, namely, the quality of the iron, the rate of grinding, the difference in diameter between rolls with which it has worked in the mills, the grooving and the amount of iron that has passed through the mill. In a high rate grinding mill the average life of a shell is approximately four years, in a low rate grinding mill the average life ranges between six to seven years. The average life of a mill roll shaft is about fourteen years. The cast iron of which a mill roll shell is made should be of a coarse grain and it should roughen by its use. It should not be too hard nor too soft.

The life of a crusher roll shell is approximately seven years in a high rate grinding mill, if grooved with the McNeil type of grooving, or commonly called Fulton. The Krajewski type crusher rolls and the Hamilton type rolls last as long as 12 to 15 years without the necessity of being replaced. The life of the crusher shaft is approximately 17 to 20 years, depending entirely on the material used. Open hearth forged steel shafts containing from 0·20 to 0·25 per cent. carbon with ultimate tensile strength of 68,000 and 35,000 lbs. elastic limit are found to be the best for this service. Some years ago hollow nickel steel shafts were tried out unsuccessfully, it being found that they would last only about four years.

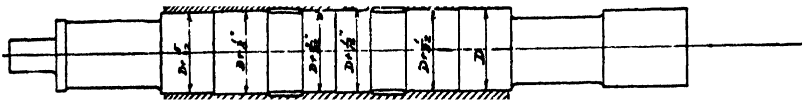
Re-shelling.—As soon as the shell of a mill or crusher roll has become so worn that it cannot be used to get the proper setting, it is removed from the shaft and replaced by a new shell. The operation of removing the old shell is usually done by heating the shell and pressing it out in a hydraulic press. The pressure to take it out ranges between 600 to 1100 tons depending upon the size of the roll shaft and the shell. Some manufacturers furnish their rolls with only three fits on the shaft. The Krajewski-Pesant Corporation

[1] Proceedings, Second Conference, Cuban Sugar Technologists' Association.

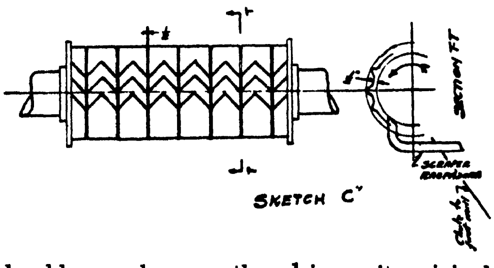
furnished most of their rolls with as high as 15 fits on the shaft. It was considered, some time ago in Cuba, that three fits were good enough for mill purposes.

The Cuban shops during the war did most of the re-shelling work that was to be done during that time and it was found in practice that a good many of the rolls re-shelled in Cuba came loose during the grinding season. Some came to the conclusion that it was necessary to improve the method of re-shelling to avoid these difficulties which increased the time lost in the mills to replace rolls with loose shells. The new method that is used at the present time by most of the reliable local shops in Cuba is to provide six fits instead of three, as was the old-time Cuban practice. It is found that by using six fits the number of rolls coming loose from the shaft while grinding has been reduced to almost nothing. A description follows of a six-fit method, which is considered to-day to be the standard Cuban practice :—

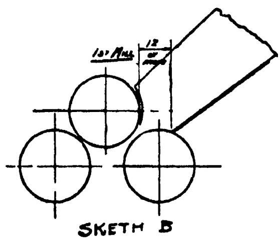
The rough shell is bored to size with six step fits ; the difference in diameter of the step fit is about $\frac{1}{32}$ in. (sketch *A*). It is understood that an allowance should be made for the amount to be taken off the shaft for finishing, which



SKETCH A"



SKETCH C"



SKETH B

should never be more than $\frac{1}{8}$ in. on its original largest diameter. The shaft is turned to a smooth surface with the six fits, each fit being $\frac{1}{32}$ in. smaller in diameter than the preceding fit, and each fit must be 0·017 in. larger in diameter (the fit allowance) than the corresponding fit in the shell. The shaft is then covered with a small portion of white lead and placed in the shell with hydraulic pressure, the required pressure to do this varying in accordance with the size of the shaft. For small size rolls—5 ft. 6 in. to 6 ft.—some 850 tons are required and for a size roll of 6 ft. 6 in. to 7 ft. from 950 to 1100 tons. It should be remembered that the pressure increases as the shaft is being pushed in, and that the pressures given are the pressures at the final position of the shaft.

While the shaft is being pushed into the shell, the gauge on the hydraulic press should be observed and the pressure at each inch of travel logged : should any abrupt rise in pressure be noted, the shaft should be immediately pushed off in the opposite direction and examined, because if this is overlooked it is quite likely that the shell will crack while the shaft is being pressed in or while in operation. All shafts should have an identifying number, and data sheets of each individual shaft should be kept for reference.

Using old shells.—It has been found advantageous and economical in practice to use old shells discarded from larger size mills in the smaller size mills. For instance, the discarded shells from a standard 36 in. × 84 in. mill can be used on shafts of standard mills 34 in. × 78 in. and 34 in. × 72 in. Further, shells removed from 36 in. × 78 in. can be used on 34 in. × 72 in. mills. In general, the shells removed from larger size mills usually have larger size bore than shafts on which these shells are to be used. The most economical method found in practice to increase the diameter of the shaft, so as to take the shell with large bore, is by bushing the shaft. Building up electrically is slow and expensive, and in some cases the machining is found difficult. The procedure for bushing the shaft is as follows :—

Bushings are made up of 8, 10 or 12 in. wide steel flats of the proper thickness, with the ends electrically welded. These bushings are turned on the inside with an allowance of $\frac{1}{32}$ in. smaller than the shaft for shrinking on ; they are then heated up and slipped on the shaft. After all the bushings have been placed on the shaft, it is turned with the required six fits, and the re-shelling is done in the manner described above. In case the shell has two grooves per in. or has larger grooving, the shaft is pushed into the shell while re-shelling so that the male or female of the grooving shall come on the centre line between journals, depending on whether the roll is top or bottom grooved. After the shell is placed on the shaft, this is cut to the proper length, making an allowance for juice guards, then re-dressed accordingly.

Grooving.—It is a good practice to start grooving all rolls always from the centre line of the rolls and to use the feed screws of the lathe so that the grooving will come very even. In general, top roll grooving is called that which has the male of the groove at the centre line of the shell, and the grooving having the female at the centre line of the shell is called bottom grooving.

Flanges.—It was common practice several years ago to make the flanges of top rolls integral with the shells. This method caused two difficulties : first, that whenever a flange was broken, it was necessary to replace the roll, and second, when the lateral play between the bagasse roll and the top roll became too great, it was impossible to bring the flanges closer so as to have just the proper clearance, which should not be more than $\frac{1}{16}$ in. Later on, loose solid flanges were used, but with these when a flange broke it was necessary to replace the roll as in the case of the solid flanges in order to remove the broken flange. It has been found more practical to make all flanges loose and split so as to overcome the above mentioned difficulties.

The best material that can be recommended for making these flanges is cast steel $2\frac{1}{16}$ in. thick ; the flanges should be fastened to the shell by means of sixteen $1\frac{3}{8}$ in. steel bolts. The depth of the tap on the shell should not be less than $1\frac{3}{4}$ in. The flanges themselves are counterbored so that the head of the bolt shall be flush with the outside of the flange. The outside diam. of the flange should be made as follows :—

For first mills it should be 8 in. more than the nominal diam. of the roll ; that is to say, for a 36 in. mill its outside diam. should be 44 in. For the other mills the diam. is to be 6 in. larger than the nominal diam. of the roll. It should be kept in mind that the bolt circle should be such that there will be enough metal between the outside surface of the roll when worn and the bolt holes.

Cracked Shells.—It has been found in practice that too large a fit allowance has been the cause, as a rule, of cracked shells. Some shops use the method of pressing the shaft into the shell by heating the shell while the shaft is being pressed on. This method is very dangerous on account of cracking

the shells and should never be accepted as good standard method for re-shelling. As a rule, too large a fit allowance is indicated by a longitudinal crack.

Some of the old type mills have their mill roll shafts with only two fits, one at each end of the shell, the shell being hollow in the centre. The shaft is smaller in diam. at the centre than at the two ends where the shell fits. It has been noticed that many rolls having shafts of this type have had their shells cracked usually circumferential, at their centre line. Two methods have been used to improve shafts of this type. One is by building up the shaft electrically at the centre line; the other method is to place a false fit in the centre line, made of steel flat or tank plate. This false fit is made in two halves and held on the shaft with cone head screws.

Mill troubles.—As a matter of interest the writer will mention a few instances of mill troubles caused directly or indirectly by mill rolls: It has been found where mill rolls have become shiny, that the mills where they were working have completely refused to take the feed. Some of these rolls have been improved in this regard by taking off about ½ in. in its diam. and being re-grooved. It has been found that the reason for the glassing-up is due to a defective method of cooling down the casting from which the shell was made, resulting in a partially chilled surface, so hard that it will not roughen while grinding.

In some mills, particularly those of high grinding rates, the first mill of the tandem has a tendency to choke. One of the chief causes of this is that the bottom of the chute from the crusher to the first mill is too high. The crushed cane, together with the juice going from the crusher into the first mill, is discharged too near the entrance of top and bagasse rolls, not allowing enough time and space for the juice to get away before the crushed cane enters the first mill. This difficulty has been overcome by lowering the bottom of the chute so that the distance measured horizontally from the surface of the top roll to the end of the bottom of the chute be 12 in. or more (sketch *B*). This particularly applies to milling plants which still use the Krajewski type of crusher rolls, and to mills where the rate of grinding is very high.

In first mills preceded by Krajewski crusher the trouble of choking in the first mill has been overcome by Messchaert grooving in the bottom roll of the Krajewski crusher. Incidentally, this increases the capacity about 15 per cent. and at least 2 per cent. the extraction in the crusher itself. The Messchaert grooving should be ¾ in. wide and 1 in. deep measured from the bottom of the corrugation. It is not necessary to make Messchaert grooving at each zig-zag but to make it at the zig-zag end where it points towards the mills so that when the juice tends to follow along the roll it will drain to that point (sketch *C*). It will be necessary when making Messchaert grooving to place scrapers for the grooving at the discharge end of the crusher. (Sketch *C* again). It is important that the scrapers be located in the position shown in the sketch.

HERISSON CRYSTALLIZERS[1].—Claims made for the new Herisson water-cooled crystallizers, 42 sets of which have been ordered during the last 12 months, four being for refineries in the United Kingdom, are: massecuite of any kind cooled in 25 to 50 per cent. of the usual time; yield of sugar improved; number of crystallizers can be reduced or output increased; price moderate; cooling water 30 to 60 per cent. on weight of massecuite according to circumstances; one water regulating valve; no attachments to, nor obstructions in body of crystallizers; space required the same as for ordinary type; no alteration to existing arrangement for handling massecuite; and can be fitted to existing crystallizers at moderate cost.

[1] U.K. Patent, 313,290. See also *I.S.J.*, 1929, 447.

Publications Received.

The California and Hawaiian Sugar Refining Corporation. Boris Emmet, Ph.D. (Graduate School of Business, Stanford University, California, U.S.A.)., 1929. Price : $2.50.

This volume is described as " A Study of the Origin, Business Policies, and Management of a Co-operative Refining and Distributing Organization," and Dr. Emmet, its author, is a member of the staff of the Graduate School of Business, Stanford University. The C. & H. Corporation has been well chosen as a subject for such a study. It is an immense concern, the melting capacity of the Crockett plant being no less than 2500 tons per day. It has worked out far-reaching management policies, being concerned with the production of the raw material, with its shipment from Hawaii, with its manufacture to refined sugar, with the distribution of its product, and with the control and financing of the whole into a vast and successful organization.

The book studies the administrative and business problems concerned with this great organization; and in particular deals with the operations of refining, sales, financing, and accounting. Thus the reader is introduced to refinery budgets relating to production, refining cost, and labour cost, tables showing to what extent during several years past these estimations were realized. He is given close information on different departments, such as those relating to chemical control, inspection, engineering, warehousing, and stores. He is shown the central sales organization, the customer classification, data on advertizing, and the seasonal demand for sugar.

A chapter headed " Progress and Results " contains much suggestive information. Progress in extraction (yield of granulated sugar) is followed, so that whereas the index figure was 100 in 1915, it became 102·25 in 1927, the reasons which have led to this result being traced. The regulation of the production through out the year, and the effect of the rate of melt on the unit cost of refining, are studied. Other subjects are : labour turnover, productivity of refinery equipment, improvement of material and equipment, and progress in cost reduction, the tables illustrating these investigations giving only index figures, not actual values. In this chapter one sees a list of the principal labour-saving devices that have been installed during the past few years at Crockett, amongst those mentioned being : a weighing and conveying installation, a soft-sugar carton packer and weigher ; a melt centrifugal control ; a kieselguhr regenerating plant, and the Oliver filter installation for the mud-press station. A point is made of the policy of encouraging employees to work out ideas for themselves, these being patented (if valid) at the company's expense, the company retaining the free use of the invention, and the inventor all other rights. Our impression of the book as a whole is that it contains an immense amount of material which cannot fail to be valuable to the student of business methods, to the economist, and to the works manager.

Saving Labour in Sugar Beet Fields. L. A. Moorhouse and T. H. Summers. Farmers' Bulletin No. 1042. (U.S. Department of Agriculture, Washington, D.C., U.S.A.). 1929. Price : 5 cents.

By the use of larger equipment is the way in which many beet growers in the districts of Colorado, Montana, Idaho, and Utah, have been able to reduce their figure for man-labour per acre. Examples are given of the effect of the use of different size crews and different size and type of implements. Thus, ploughing with a two-bottom, four-horse plough can be done twice as fast as with a single bottom, two-horse plough. A one-row lifter with four horses will cover nearly double the acreage in a day compared with a one-row lifter and two horses, and similarly with discing, harrowing, cultivating, etc. Some progress has been made in mechanical beet harvesting machines, but as yet they are in the experimental stage. As the man labour for the handwork in harvesting beets varies from 24 to 30 hours per acre, it is clear that there is incentive for development in this direction.

The Cuba Sugar Manual, 1928-29. Compiled by A. B. Gilmore. (A. B. Gilmore, P.O. Box 771, New Orleans). Price : $10.

This manual is in its second year of issue, and has been enlarged and extended in its scope. It is in two sections Spanish and English. It presents in respect of each factory in Cuba a miscellaneous mass of relevant information under uch heads as : Administration ; Communications ; Cane Supply ; Cane Handling ; Milling Equipment ; Electric Plant ; Steam Plant ; Clarification ; Evaporation ; Vacuum Pans ; Centrifugals ; Storage Capacity ; General Remarks ; etc. Also a section to each factory on "Agricultural Information." Through these classifications it is possible for the reader to get a very good idea of the equipment of any particular central.

Verslag eener Reis ter Bestudeering der Suiker-industrie op Java. H. A. C. van der Jagt. (Stichting Industriefonds, Dordrecht, Holland). 1929.

Dr. VAN DER JAGT is Lecturer on Sugar Technology at the Dordrecht Technical School, where sugar engineers and chemists receive their training for service in Java. In his booklet he gives a highly interesting account of what he saw in the Java sugar factories during a recent visit, comparing the considerable progress made since the year 1912 when he was last in that country. Briefly the contents of the publication are as follows : Chapter I : Information regarding the study-tour, and some considerations on the Javan. Chapter II : Processes introduced since 1912 (DE HAAN'S carbonatation, HARLOFF'S acid thin-juice, hot raw juice sulphitation, ALTMAN'S sulphitation, VAN DER JAGT'S sulphitation, mud treatment, defecation modification, the mud-on-bagasse process, thick-juice treatment, massecuite working re-melting of after-product sugar). Chapter III : Machinery improvements since 1921 (mill installations, the Searby shredder, Messchaert grooves, Meinecke carriers, rake carriers, juice-lifts, juice-sieves and bagasse conveying installations, bagasse balers and briquetters, juice measuring and weighing machines, filter-press station improvements, a visit to the Goenoengsari s.f.). Chapter IV : Visit to the Experiment Station of the Java Sugar Industry at Pasoeroean. Extracts from Dr. VAN DER JAGT'S interesting report will be reproduced elsewhere in our coloumns.

Metodo Racional para el Pago de la Cana de Azucar. Eduardo E. Saldana. (Published by the author at Mayagüez, Porto Rico). 1929.

Mr. SALDANA, Engineer of the Mayagüez Sugar Co., P.R., makes a close study in this book of the different systems by which payment for cane to the farmer has been made. His general conclusion is that payment will not have been put on the most stable basis until the sugar in the cane (or its value) is divided between mill and farmer in proportion to their respective capitals, costs, and risks, the ideal system being one which will stimulate the grower to produce a cane of good quality at a low cost and compel the mill manager to approach a high standard of efficiency.

The Problem of Fermentation : The Facts and the Hypotheses. M. Schoen ; translated by H. Lloyd Hind, B.Sc., F.I.C. (Chapman & Hall, Ltd., 11, Henrietta Street, London). 1929. Price : 21s.

As Prof. A. FERNBACH, the noted investigator, remarks in a preface which he contributes to this book, the continuous evolution of scientific knowledge demands from time to time a review of the past, in order to measure the road which has been covered. M. SCHOEN'S monograph cannot fail in this way to be of service to all who may be interested in fermentation. It reviews, for example, such matters as PASTEUR'S theory in the light of recent discoveries, the enzyme theory of fermentation, the mechanism of bacterial fermentations, phosphates and fermentation, the reaction of the medium, and hydrogen ion concentration and fermentation. Theories and facts are well presented, and the clear way in which modern theories are exposed is the leading feature of the work. It is one which will both interest and impress those wishing to be abreast of to-day's knowledge of a subject which has always presented particular interest.

Brevities.

RESEARCH.—" Research is not a luxury, to be enjoyed only by academic workers on one hand and huge corporations on the other. It is applicable to all business concerns—sick or healthy, and regardless of their size.[1] Broad adoption of research by business is inevitable, and those concerns quickest to embrace it will reap the earliest benefits. Most of the companies making large profits in this period of checkered prosperity have adopted research. But it should be recognized that these concerns did not employ research because they were big—they used it to get big."

CONCENTRATED FERTILIZERS.—New types of fertilizer mixtures bearing analyses as high as 16-32-16 are now being offered. This means a total of 64 per cent. plant food elements or 1280 lbs. of real fertilizing material to every gross ton. Assuming that the plant food materials at the shipping centres take the same price in the concentrated mixtures as in normal fertilizers, then the planter should reap the benefit of a large saving in freight when he buys the new style fertilizer. He should also save in the work of applying the material.[2]

pH OF BEET FACTORY PRODUCTS.—Determinations by E. Saillard[3] carried out in French factories showed the following *pH* values: first carbonatation juice, 9·75-10·23; second carbonatation juice, 7·86-9·23; first and second massecuites, 6·9, but this can descend in the latter to 6·2 without inversion; molasses, lower than 7·0, three being 6·1 with reducing sugar contents carrying from zero to 0·26 per cent. A sample at 6·5 *pH* contained no reducing sugars. Most of these results were obtained with a potentiometer.

BALING BAGASSE.—Green bagasse is baled at Central Silay, P.I. with the Bratt apparatus, and stored in open sheds, when after six months the moisture content is reduced from 45-47 to 17-20 per cent. In this state it forms a good fuel for locomotives on the estates. The cost of baling the green bagasse including piling in the sheds is 1 peso (50 American cents) per metric ton; and 5 tons of the green material give about 2½ tons of the partly dried, which is equal in fuel value to 1 ton of coal. As 1 ton of coal at the mill costs 25 pesos, this means a saving of 20 pesos. The baler and its foundation cost 9000 pesos ($4500) complete. Before purchasing the baler, the cost of disposing of the surplus bagasse piled in the yard was 40 pesos per cane car holding 1½ ton, so that the baler has proved a good investment.[4]

SUGAR FOR ENERGY.—Dr. Thaddeus L. Bolton, Head of the Psychology Department, Temple University, Philadelphia, reported that the "physical and mental let-down which frequently occurs during the busiest period of the office day is to a considerable extent due to insufficiently or improperly balanced diets, and can be largely if not wholly prevented by the timely eating of foods that in small volume act as quick fuel for the body engine." Sugar is the food indicated. "On the basis of our findings, hard-working business and professional men and women would do well to keep in the drawer of the desk a box of good candy or candied fruit. When energy begins to flag in mid-afternoon, these quick-action foods will act as an emergency ration and supply the calories needed for the rest of the day's work. The sugar in afternoon tea, or in sweetened cold drinks, will have the same effect."

MOLASSES FORMATION.—At a recent general meeting of the German Society of Sugar Manufacturers, held at Magdeburg, a discussion took place on the causes of the formation of molasses. Dr. Zscheye produced evidence that it is the organic salts and organic non-sugar substances that exert the melassigenic effect. If 100 grm. of molasses are incinerated, and the ash introduced into a solution of sugar in the ratio of 1 : 5, then crystallization proceeds perfectly. On the other hand if potassium glutamate be added to a solution of sugar, an artificial molasses is thus formed. Dr. Pillhardt mentioned that sugar factories using the water of the River Saale, which had become contaminated with large amounts of sodium and potassium salts, had found their molasses to increase. Dr. O. Spengler said that he had been asked to investigate this question of the effect of alkali-containing waters, as it seemed clear that such may exert a prejudicial influence on the results of manufacture.

1 From a leaflet entitled "Militant Business," issued by Barrington Associates, Inc., of U.S.A.
2 *Sugar News*, 1929, 10, No. 4, 251.
3 *Suppl. Circ. hebd.*, 2095 of 1929. 4 *Facts about Sugar*, 1929, 24, No. 23, 545.

BEET SEED "BOLTING."—Experiments carried out by E. Saillard[1] on four farms in France with different French and foreign beet seeds showed the tendency to "bolt" (to run to seed in the first year of growth) is affected by the time of sowing. Thus the same seed in the same field, sown either in March or in May, gave plants which bolted in the first case and not in the second. These tests also showed that the Hilleshog variety had less tendency in this direction than any of the other varieties tried (which included Dippe, Rabbethge, Vilmorin, etc.).

GLYCERIN.—The sulphite fermentation process was patented in Germany in 1915 and rapidly adapted to large scale operations by the "Protol" Company there, with the support of the military authorities. More than one million kilograms of glycerol per month were manufactured in this manner, the technical yield being 20-25 per cent. calculated on the sugar. Refined or crude sugar or molasses was used with equal success. In this manner the supply in Germany of munitions glycerol was rendered independent of the shortage of fats.

UNITED MOLASSES.—The National Distillers Products Corporation of New York has contracted to sell to the United Molasses Company of London, its molasses business represented by stock ownership in the Old Time Molasses Company, a Cuban corporation, also 100 per cent. of the Solex Car Line Corporation and one-half interest in the Eastern Alcohol Corporation. The last-named company owns and operates a large and up-to-date industrial alcohol plant, situated in Philadelphia. The other half interest in Eastern Alcohol is owned by E. I. du Pont de Nemours & Co.

BEET COSTS IN HOLLAND.—The Agricultural Society of Overijssel, Holland, has conducted during several years past trials on the costs of beet cultivation on a farm in the North of Brabant.[2] During 1928 the sowings on this farm amounted to 3·7 acres, and the following are given as the principal costs per hectare in Dutch florins: Preparation of the soil and sowing, 56·00; seed (18 kg. at 0·60 Fl.), 10·80; cultivation, 96·62; manure, 218·50; harvesting, 40; transport, 33·23, other smaller expenses, 121·85; a total of 577·00 Fl. This is compared with the following receipts: 33,233 kg. roots at 17·66 per cent. of sugar, 603·63 Fl.; 25,000 kg. leaves, 150·00 Fl.; and allowance for the cost of loading, 25·00 Fl., that is a total of 788·63 Fl., leaving a profit of 201·63 Fl. per hectare. The price of the roots delivered to the factory, 18·16 Fl. per 1,000 k.g.

CLAASSEN'S NEW PATENT.—In one of the German technical papers[3] an advertisement has recently appeared which on translation reads as follows: "More Sugar; obtaining sugar from exhausted press scums; Dr. Claassen's German Patent; according to this new process, the sugar remaining in the press scums after its exhaustion, the quantity of which is greater than is indicated by the usual mode of analysis, can be extracted to the amount of one-half by a single clarification, and almost entirely by double clarification, and this without the juice being more diluted than usual." Advantages claimed are: simplification of the press work; economy in presses and in filter-cloth; and more rapid and more complete exhaustion. No information regarding to method is given. This process would, however, appear to be the result of some researches recently reported,[4] showing how sugar can be more completely extracted from filter-press cake.

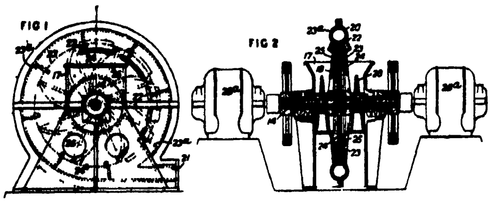
PALATABLE BEET SYRUP.—What may be an important patent was recently taken out by Henry W. Dahlberg, of the Great Western Sugar Co., of Denver, Col., U.S.A., for a method of preparing "an edible and delicious syrup of high purity, which is suitable for table use" from dark, bad-flavoured beet molasses, a problem which has engaged the attention of many skilful chemists. The steps of the process which is now claimed[5] are as follows: treatment with lime to form saccharate and waste water; filtration; treatment of the saccharate obtained with carbon dioxide to form a lime precipitate and a saccharate juice which is unpalatable; filtration; acidifying the saccharate juice say with acetic acid; and subjecting this to the action of the enzyme invertase to invert approximately 65 per cent. of the sucrose. It is stated that the bitter material is thus converted into a palatable edible syrup, though "just what happens to effect the change in flavour is largely problematical."

1 *Suppl. Circ. hebd.*, No. 2091 of 1929.
2 G. VAN DER GIESSEN: *Tijdschrift*, 1928, 129, 164-171.
3 *Die Deutsche Zuckerindustrie.* 4 *I.S.J.*, 1929, 331. German Patent, 476,715; U.K. Patent, 296,985. 5 U.S. Patent, 1,584,166.

Review of Current Technical Literature.[1]

Morgan Cane Disintegrator. **Wallace Montgomery.** *Facts about Sugar*, 1929, **24**, No. 28, 664-667.

For many years, the late Colonel W. H. Morgan of Alliance, Ohio, worked to develop a cane disintegrator,[2] with the object in view of preparing cane as efficiently as possible for passage through the mill rolls to obtain the highest extraction. Following his death, the apparatus was taken over by the International General Electric Co. and a machine of a new type and of enlarged capacity has been in operation at Central Hershey in Cuba during the campaign just closed. It has a large capacity; rates as high as 180 tons of cane per hour have been recorded. The preparation is excellent and the product readily lends itself to milling. It can be installed in connexion with any existing tandem, the cane going to the disintegrator from the main carrier by-passing the crushers. The usual arrangement is to cut the cane with knives and then pass the cut cane to a high speed rubber belt conveyor, above which is a lifting magnet. As a further safeguard the belt passes over a magnetic pulley; thence the cane is discharged into the hopper of the disintegrator, which discharges on to a drag conveyor that distributes the mass on the intermediate carrier of first mill. The combination of lifting magnet and magnetic pulley, together with the fact that the cane is well cut and the mat only 6 or 8 in. in thickness, entirely



eliminates the possibility of tramp iron entering the disintegrator. The prepared cane discharged from the disintegrator resembles hay, somewhat, although it contains all the juice. There is decidedly less "cush-cush" returned to the mill from the cane prepared by the Morgan disintegrator; this no doubt is due to the long fibre and mat packing, as well as to the fact that the crushers, always a source of much "cush-cush" and cane pieces, are not operating. There is no loss of juice in preparation. Tests run to determine the juice extracted by the first mill with the Morgan show a greater extraction than with the double crusher and first mill.

	Two set knives Morgan disintegrator and first mill.	One set knives double crusher and first mill.
Extraction normal juice per cent. cane	68·50	63·05
Extraction juice per cent. total juice in cane	76·60	70·96
Extraction sucrose per cent. sucrose in cane	80·45	76·90

Variations in per cent. fibre do not affect the operation of the disintegrator, cane with either high or low fibre content being equally well prepared. Due to the excellent preparation the rolls have only to squeeze out the juice. From the experiments that have been made so far it is apparent that there will be a decided saving in the wear and tear on rolls and that finer grooving can be used. The volume of the prepared cane from the Morgan is approximately six times that of whole cane. One cub. ft. of the prepared cane, loosely packed, weighs from 16 to 18 lbs. The table at the end of this article shows at a glance results obtained over the period of the test at various grinding capacities. It may be noted that the mill on which these tests were made was set for ordinary operation with double crushers and one set of knives; it was therefore impossible to obtain maximum results, due to the first mill not taking the cane properly, and to flooding with juice. With proper grooving on the first mill the bagasse leaving here corresponds very favourably to that from a nine roller mill and double crusher at the same tonnages. Further experimenting is contemplated for the next crop, and as the machine is on the ground and ready for operation,

2 Patented; see *I.S.J.*, 1927, 392.

full crop data and steady operation will be obtained. Different type milling equipment will make possible large returns to the mill owner by increased extraction and reduced upkeep, as well as by saving in power consumption.

Tons cane per hour	Normal juice per cent. cane 1st mill only	Normal juice per cent. cane total	Dilution per cent. cane	Sucrose in bagasse per cent.	Moisture in bagasse per cent.	Extraction sucrose per cent. sucrose in cane.
129·50	65·52	78·43	None	3·54	44·60	94·68*
120·50	72·69	—	12·54	2·37	44·80	—
115·80	67·23	78·66	11·02	2·15	44·20	96·87
120·80	71·73	80·24	11·36	2·14	45·60	97·03
139·00	65·33	78·84	12·38	2·44	2·44	96·38
108·20	65·14	78·98	10·38	2·45	47·30	96·37
105·33	—	80·29	14·00	2·78	47·00	95·36
99·94	—	80·88	16·51	2·89	48·33	95·27
123·39	—	78·64	13·39	2·81	47·83	94·98
	Per cent. fibre in cane					
120·42	13·38	75·80	13·79	3·21	47·33	93·49†
			Average			
118·29	67·94	78·97	12·82	2·68	46·23	95·60

* Dry milling test. † Grinding Uba Cane.

EXPERIMENTS ON THE RAPID COOLING OF LOW GRADE MASSECUITES. **Arnold H. Warren.** *Sugar News* 1929, **10**, No. 5, 317-323.

Experiment 1.—A low-grade massecuite was boiled in a calandria pan, as usual, obtaining a fairly uniform and not very large grain. Some false grain developed during the boiling of this strike. Some of the massecuite was placed in cans, which were cooled down to 31°C. in 13½ hours, when it was purged. This took an hour and 14 mins., and it was thus possible to obtain a molasses of about 30° apparent purity by simply cooling down to the temperature named. *Experiment* 2.—About 3 cub. ft. of the same massecuite were taken from the crystallizer 14 hours after the strike was dropped, its temperature then being 62°C. This was dried in a 40 in. centrifugal, when it was found that the duration of purging was 10 min., giving a sugar of 89·4° purity. On the other hand, when the temperature of the massecuite was 31°C., 74 mins. were required, and the purity of the sugar was 72·8°. It was thus demonstrated how much more rapidly any low-grade massecuite purges hot than when cold. Cooling, however, is essential to the rapid exhaustion of the molasses, and it is suggested that the Lafeuille crystallizer pan offers an ideal means of warming the massecuite to a suitable purging temperature after it has been cooled. *Experiment* 3.—Two portions of the same *B*-massecuite were each purged 14 hours after the strike was dropped, but one had been cooled rapidly and the other slowly. It was found that the apparent purity of the waste molasses was in the first case 30·27 and in the second, 33·35° *Experiment* 4.—A low-grade strike was boiled, not of uniform grain, but free of false grain, and dropped into an ordinary U-type crystallizer, at a temperature of 70°C., and there allowed to air cool for three hours, the temperature dropping 4½°. Next several tins were filled with it, and the temperature allowed to drop 5·5°, then water-cooled down to 27°C., the total cooling time being 11 hours. This massecuite was purged at 33°C., this taking 20 mins. Waste molasses at 32·28° apparent purity was obtained, that is a drop in purity from massecuite to molasses of 28° in 11 hours. This experiment demonstrated that if the massecuite is free of false grain at the time it leaves the pan, the rapid cooling does not prevent its purging well. In his conclusions, the author points out that his experiments show that the capacity of the low-grade centrifugals can be at least doubled by raising the temperature of the massecuite to 60°C. before it is purged. Surely, therefore, he says, this advantage warrants capital expenditure for a machine by means of which the warming of the massecuite can be economically and safely accomplished.

Review of Current Technical Literature.

Cane Wax Complex in Cane Mills. C. F. Bardorf. *Industrial and Engineering Chemistry*, 1929, 21, No. 4, 366-367.

In a previous communication the author has dealt with the migration of the cane wax complex through a refinery,[1] and he has now applied the same methods in four centrals in Cuba. He found the cane wax extracted from the crusher juice (per cent. Brix) to be about 0·39 to 0·83 : from the first mill, 0·24 to 0·50 ; from the second, 0·5 to 0·7 ; from the third, 0·26 to 0·6 ; and from the fourth, 0·18 to 0·52. Here are his results for mixed juice and defecated juices, and evaporator syrup :—

	Central A		Central B		Central C		Central D	
	Brix and Purity.							
	° Brix	P.	° Brix	P.	° Brix	P.	° Brix	P.
Defecated juice	13·6	80·2	14·1	83·4	14·1	80·6[a]	17·8	84·4
Syrup	50·5	80·8	63·4	83·6	54·3	80·6[b]	15·4	82·7
Press-filtered juice ..	12·5	79·2	—	—	—	—	52·4	84·6

	Wax Extracts			
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Defecated juice	0·196	0·230	0·159	0·137
	0·194	0·326	0·152	0·082
	0·390	0·556	0·311	0·219
Syrup	0·075	0·190	0·085	0·101
	0·070	0·112	0·077	0·094
	0·155	0·302	0·162	0·195
Press juice	0·184	—	—	—
	0·108	—	—	—
	0·292	—		—
Secondary juice	—	—	—	0·583
	—	—	—	0·327
	—	—	—	0·910

While in the following table are given the percentages of cane wax in the raw sugars produced (polarizing 97 to 98·5°) :—

	Central A	Central B	Central C	Central D
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Raws of 1926	—	0·043	0·044	0·017
	—	0·023	0·109	0·014
	—	0·066	0·153	0·031
Raws of 1927	—	0·076	0·079	0·078
	—	0·058	0·117	0·147
	—	0·134	0·196	0·225
Raws of 1928	0·0469	0·0404	0·0445	0·0366
	0·0225	0·0245	0·0235	0·0216
	0·0694	0·0649	0·0680	0·0582

In so far as these limited investigations have gone, it appears that the migration of the wax in cane mills resembles that in a refinery. In both cases the various extracts are quite similar, or have many points of resemblance, and it will no doubt be established that the complex maintains its character even after having passed through many processes from the cane mills to the finished products of the refinery.

Data of "La Carlota" Central, P.I., 1928-29. H. Gifford Stower. *Communicated to this Journal by the La Carlota Sugar Central, Negros Occ., P.I.*

Commencement of crop, November 5th, 1928 ; termination of crop, March 28th, 1929 ; possible working days, 123 ; days of 24 hours, 120·8 ; days of 24 hours worked, 119·2 ; average of hours worked per working day, 23·16 ; average of hours worked per day of 24 hours, 23·41 ; time lost due factory, 11·48 ; time lost due to want of cane, 25·58 ; based capacity of mills (metric tons) 3000 ; average milled per working day (metric tons) 3773 ; average milled per day of 24 hours (metric tons) 3842 ; average milled per 24 hours worked (metric tons) 3894 ; total sugar manufactured,

[1] *I.S.J.*, 1928, 488.

sacks of 57·5 kilos net, 989,142; total sugar manufactured, tons, 56,875; total cane milled, metric tons, 464,129; average purity crusher juice 87·24; fibre in cane, average, 10·72; tons of cane per ton of sugar, 8·16; total number of cars loaded, 110,522; average weight per car, 4·20; acres cropped, 28,718; average metric tons of cane per acre, 16·16; hectares cropped, 11,622; average metric tons of cane per hectare, 39·94; average extraction in mills, 94·41.

A.O.A.C. REPORT ON THE ANALYSIS OF SUGAR PRODUCTS: DETERMINATION OF (*A*) MOISTURE. **J. F. Brewster.** (*B*) SUCROSE BY DOUBLE POLARIZATION. **F. W. Zerban.** (*C*) REDUCING SUGARS. **R. F. Jackson.** *Journal of the Association of Official Agricultural Chemists*, 1929, **12**, No. 2, 156-158, 158-166, and 166-169.

(*A*) SANDERA[1] states that none of the methods so far employed for the determination of dry substance in sugar products will give absolute results, but that the refractometric method is to be preferred. This statement perhaps summarizes the opinion of most investigators. The recently published results of BROWN, SHARP and NEES[2] were obtained with a drying method applied to high purity beet syrup in which painstaking attention to details was observed. The results were in excellent agreement, but the authors point out that this procedure is too time-consuming for any but special cases, in which the effort to obtain close results is justified. They do not recommend their procedure as being applicable to cane products. RICE, who applied this method with the addition to the distillation mixture of diatomaceous earth, reported satisfactory results in the analysis of refinery syrup containing a high percentage of reducing sugars. It would seem, however, that this method would be open to the same criticism as the other drying methods, in which so much depends upon the composition of the product and the exact conditions of analysis. In the present status of the methods for the determination of moisture in sugar products it has been suggested that a study be made of the refractometric method, with the end in view of finding a procedure that may yield concordant results in the hands of different operators. It is recommended (1) That studies of these methods be continued. (2) That the refractometric method receive particular attention (*a*) by a survey of the tables of refractive indices corresponding to sucrose concentration; and (*b*) by a study of the influence of known quantities of impurities upon the refractive index of sucrose solutions.

(*B*) Whereas the amides present in cane juices (known to affect the results of the double polarization method) can be easily isolated in crystalline form, the large amount of colloidal matter in cane molasses prevents their separation, as well as that of the amino-acids. Efforts in this direction are therefore discontinueed for the time being. Reviewing the work done on the different double polarization methods during the past two years the following conclusions are drawn: (1) In the analysis of complex mixtures resembling cane products and containing sucrose, invert sugar, reversion products, and asparagin or aspartic acid, the invertase method must be used to determine the actual sucrose content. (2) The sucrose result by JACKSON and GILLIS method No. II[3] is increased by reversion products hydrolysed under the conditions of the experiment, but it is not affected by the presence of asparagin or aspartic acid. (3) The sucrose result by JACKSON and GILLIS method No. IV is increased by the hydrolysis of reversion products in the same way as that by method No. II, but it is lowered in the presence of asparagin or aspartic acid. (4) The difference between the sucrose result by JACKSON and GILLIS method No. II and that by the invertase method gives an approximate measure of the reversion products hydrolysed by hydrochloric acid under the conditions of the analysis. (5) The difference between the sucrose result by JACKSON and GILLIS method No. II and that by No. IV gives an approximate measure of the asparagin or aspartic acid present. (6) The plain acid method may give any kind of a result, depending on the relative proportions between the different constituents of the mixture analysed.

---

1 *Z. Zuckerind. Czechoslovak. Rep.*, 1928, 53, 1. 2 *I.S.J.*, 1928, 308. 3 *I.S.J.*, 1920, 640.

(*C*) Despite the large number of methods proposed for the determination of reducing sugars, the MUNSON and WALKER is that mostly employed. Often the cuprous oxide obtained is directly weighed, but this is inaccurate when crude substances are being analysed, owing to the possibility of contamination by organic and inorganic impurities. Whereas the electrolytic method of ascertaining the amount of this copper is laborious, the thiosulphate titration process is simple, rapid and reliable, the starch end-point being sharp and decisive. A modification of this method is therefore now adopted as official. LANE and EYNON's method[1] is largely displacing gravimetric methods, but one outstanding objection (according to this writer) to all volumetric methods is that the time of reaction is necessarily variable while the end-point is being sought. Instead of adding the sugar solution in 10 c.c. portions, it is recommended that it should be added rapidly in indefinite volumes until the faintest perceptible blue remains, then adding the indicator and completing the titration. NYN's method[2] is not found to be perfectly selective, and a modification by which levulose may be more accurately determined is now described.

QUESTIONNAIRE ON SUGAR MACHINERY IN THE PHILIPPINE ISLANDS. **Theo. Nickelsen.** *Committee Reports for the Sixth Annual Convention of the Philippine Sugar Association*, 1928.

Mr. NICKELSEN, Chairman of the Committee on Manufacturing Machinery of the P.S.A., circulated amongst his friends a very complete questionnaire designed to cover the entire range of operations in the factory, the purpose being to elicit useful practical information from members of the Association on matters to which some have given special study. Mr. NICKELSEN hismelf returns some very interesting replies, our fourth (and last) summary of which is now continued[3] :—

Pans.—*Q*. Are your pans efficient ? If not, why ? Do you think that the coil pan under certain circumstances is superior to the calandria, and for what reasons ? *A*. Both calandria and coil pans, as manufactured from present day designs and standards are as efficient as the theory of evaporation of sugar liquids to heavy grain forming densities allow. *Q*. Can you give us a few ideas as to whether you think the design in discharge, in number and size of coils or tubes, in size of vapour space to heating surface, in arrangement of piping to take away the condensate, are all that could be desired ? If not, will you give us your ideas on any or all these points ? What is your idea in the use of some external power to discharge our pans more rapidly with accompanying minimum loss of time ? *A*. I believe that the efficiency of the vacuum pan increases as the number of square feet of heating surface in proportion to cubic feet of volume is increased. The efficiency of this pan is also increased, second, by suitable means of removal of condensate waters, third, by carrying the calandria body, or coils, to a very low point in the discharge cone of the pan, and lastly by operating the apparatus under as high a vacuum as is attainable under existing conditions. If in any of these points your pans fall short from an evaporating standpoint, your efficiency will be lowered. This does not take into consideration the time of discharge which could be effectively speeded by compressed air as also if the discharges are enlarged, and the flume system leading to crystallizers or mixers is made amply adequate in size and fall. *Condensers.*—*Q*. Have you any suggestion of what should conform to best practice in condenser work :—(*a*) type, (*b*) size, (*c*) arrangement of baffles if any, (*d*) what drop and size of space between discharge and inlet of vapours, (*e*) what should be the proportionate size of water leg ? Have you found any difference in types of condensers found in the market ? Do you notice the amount of water necessary when the orifice, or the diam. of the hole in the baffles, is enlarged and when contracted ? If so, is there a marked difference ? If you have experimented in the endeavour to increase condenser efficiency to the end of cutting down the amount of injection water, please let us have your results and methods for discussion. *A*. These, in recent years, have been so improved that whereas formerly 40 lbs. of water at 80°F. temperature with 26 in. of vacuum, was necessary to condense one pound of vapour in the condensers, improvements in

[1] *I.S.J.*, 1924, 107. [2] *I.S.J.*, 1925, 163. [3] *I.S.J.*, 1929, 219, 276, 330, 388.

design have reduced the quantity of necessary water as low as 20 lbs. for the same work. These improvements have been accomplished by the condenser manufacturers by deflecting the uprushing vapours to insure a complete contact with a constantly changing surface of nearly unbreakable walls of flowing water which, presenting a new cooling surface at every moment and preventing the passage of vapours, insures the least possible quantity of water in condensing operations. In addition to the foregoing the water, previous to entering the main body of the condensing apparatus, has been broken up into minute particles, at a point directly under the inlet suction of the vacuum pump, to insure the removal of air and other incondensible gases. The older type of condensers with grid iron, or plate baffles, needed a greater volume of water than the newer type, but the former, after re-conditioning, could be made also very efficient and economical in the amount of condensing water required. The throttling of the waters through the condensers can be made such, that actual curtailment of the work in the pans can be noticed, and by a gradual increase in size of these orifices, the actual limit of water necessary in practice in operating pans and evaporators can be arrived at. This assists us to arrive at definite figures for limits of the necessary water for the factory under working conditions, and this practical knowledge will assist a little to raise the efficiency of the evaporating apparatus, including pans, and make for the curtailment of pumping machinery and cooling systems, etc., etc. A check on theoretical values has been an important factor herein also.

Flocculation of the Colloids of Beet Molasses. **Erich Gundermann.** *Chemiker Zeitung*, 1929, No. 33, 305 and 322. Negative colloids exist in beet molasses, these being coagulable by different acids. With HCl the optimum flocculation, in respect both of rapidity and quantity, is in the neighbourhood of 3·2 *pH*, but a *pH* value at the limit of inversion suffices for the flocculation of some of the colloids. Heat and the presence of dispersed particles (as in unfiltered solutions) favour the rate of flocculation and the size of particles, as does also a density lower than 40 per cent. of dry substance. Flocculation is accompanied by a clarification, an improvement in the quality of the filtration and a decolorization. The results obtained permit one to conclude that the best purifying effect in the treatment of juices and syrups in the sugar industry by sulphur dioxide is obtained when the *pH* is quite close to the limit of inversion.—Heil Continuous Curing Method. **Eric Troje.** *Sugar Press*, May, 1929. Boiling is done in such a way that half of the nearly finished strike is dumped into the mixers, and the other half again boiled up to fill the pan, a large sized grain thus being secured in two-thirds of the total massecuite. In the continuous curing process proper, a battery of mixers is linked together by side-pockets, at the head of each of which are two mixers combining those and allowing the massecuite to flow from one mixer to the following by a small difference in the level of the massecuite contained therein. There are also cross-boards fixed inside the mixers which shut the upper half of the mixer only like a bridge and force the massecuite to pass below on its way forward. The idea is to allow only the large heavy crystals to pass, the fine grain being kept back so as to have more time to grow. Molasses produced in factories working this patented Heil method are remarkably low, but it is not yet clear how much this is due to the process and how much to closer supervision.—Action of Small Quantities of Lime on Cane Juice. **Georges Capelle.** *La Sucrerie Belge*, 1929, 48, 354-359, 369-374. Cane juice was treated (*a*) in the cold, and (*b*) with heat, and with variations of time, with 0·30, 0·60, 1·00 and 2 grms. of CaO per litre, when it was observed that in general the chemical activity of the reagent only commences at 2 grms. per litre, that is to say at the moment when the total alkalis are liberated by the lime. With 0·3 and 0·6 grms. per litre, the effect with heat is very small on reducing sugars, content of lime salts, and loss of alkalinity. Gums (as precipitated with acetic-alcohol) are hardly affected by 2 per thousand of lime.—Bacterial Count of Sugars. **L. H. James.** *Food Industries*, 1928, 1, 65-69. Bacteriological examinations of 197 samples of sugars showed the presence of aerobic saprophytes, putrefactive anaerobes and spoilage thermophiles in all types of sugars including refined. *B. coli* was isolated from only

two samples of raw sugars but the "flat sour" types were abundant. "Sulphur or hard swell" types were likewise found in many samples of raw sugar. These findings are important from the food canners' and confectioners' viewpoints inasmuch as these organisms cause certain well-defined types of spoilage.—BY-PRODUCTS OF THE CANE SUGAR INDUSTRY. **Fernando Guerrero.** *The Planter*, 1929, **82**, No. 17, 321-323. In this paper given before the Association of Sugar Technologists in Cuba, attention was drawn to the following methods of utilizing bagasse :—(1) making "Celotex," 1 ton of the raw material producing $30-40 worth of the insulating board by a process of manufacture said to be simple; (2) making paper, using, e.g., the recently protected process of J. LA ROSA, in operation at Central Tuinucu, Cuba, or that of H. VALETTE, being tried out at Central Cuba; (3) making sheets, or planks, so-called synthetic lumber, as by the VAZCANE process, which is working at Marianao, Cuba, to producing 10-12 tons of boards daily; (4) and making alcohol or cattle food by saccharification of the cellulose.—RAPID ANALYSIS OF RAW SUGAR USING A SINGLE SOLUTION. **J. Vondrak.** *Zeitsch. Zuckerind. Czechoslov.* 1928, **52**, 381-388. Water, ash and polarization can be rapidly found as follows: Twice the normal weight of the sugar is dissolved up in water and made up to 200 c.c.; water is found refractometrically using the new Zeiss apparatus and prism No. II; ash is determined by the electrical conductivity method; and sugar is ascertained by direct polarization. A table of results by this method compared with usual methods showed sufficiently close and constant results, the rendement in the case of first products raw beet sugars never differing by more than 0·16 per cent.—ARTIFICIAL SILK YARN FROM BAGASSE. **W. Brown.** *Australian Sugar J.*, 1929, **21**, No. 1, 56-57. Author claims to have elaborated a process for making viscose silk yarn from bagasse but does not go into details. The dry strength of the yarn produced is said to be at least 50 per cent. higher than that made by the existing processes; the wet strength is at least 150 per cent. higher; whilst the elasticity is such as to allow the individual filaments to be spun as fine as 2-3 deniers, or twice as fine as by known methods. Australia uses 12-18 tons of artificial silk yarn per week, all being imported, the average price being 5s. 6d. per lb. About 6 tons of bagasse (dried to 11-15 per cent. of water) and 320 lbs. of cotton linters would produce 1 ton of silk. Australia has therefore sufficient raw material to supply considerably more than her own requirements in this material.—HERISSON WATER-COOLED CRYSTALLIZER. *South African Sugar J.*, 1929, **13**, No. 5, 275. It consists of a revolving coil fitted to an ordinary air-cooled crystallizer, and has been patented.[1] Its most important feature is the efficient way in which the massecuite is mixed during the cooling; it is very even and regular, and no accumulation of sugar crystals in any particular spot takes places as in other types of water-cooled crystallizers: also the amount of return sugars in the process is reduced. Results in the factory showed a reduction of the temperature of the massecuite from 64 to 33°C. in 13 hours, as compared with a fall from 65 to 55°C. in the same time in an ordinary air-cooled crystallizer. At the factory of the Zululand Sugar Milling Co., Ltd., Empangeni, the following figures were obtained :—

	Yield in lbs. per cub. ft. 1st Massecuite	2nd Massecuite	3rd Massecuite
Water cooled crystallizer	52·29	36·36	31·56
Ordinary crystallizer	47·22	34·24	30·15
Gain in favour of water cooled crystallizer	5·07	2·12	1·41
Gain per cent.	10·70	5·50	4·40

Time for curing: 8 hours for firsts, and about 12 hours for seconds and thirds. Similar results were obtained at the Amatikulu factory (J. L. Hulett & Sons), where it was found that apart from cooling from 60 to 31°C. in 13 hours, the recovery was increased and the purity of the residual molasses was reduced.

J. P. O.

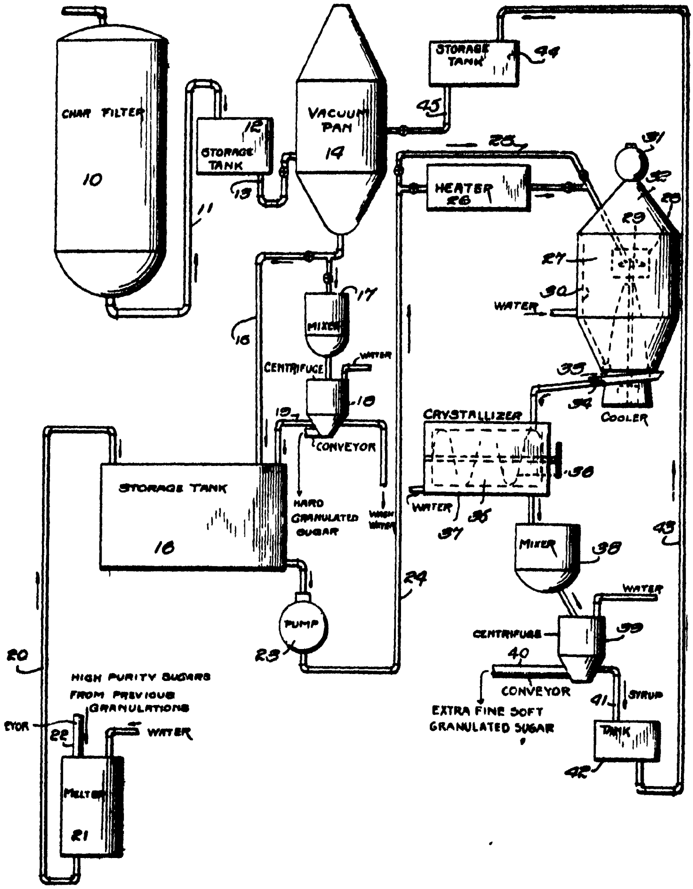
[1] J. E. R. HERISSON and PATRICK MURRAY (the latter being the representative of Messrs. Duncan Stewart & Co., Ltd., Glasgow). U.K. Patent 313,290. See I.S.J., 1929, 436.

Review of Recent Patents.[1]

UNITED STATES.

Manufacture of Extra Fine Soft Granulated Sugar. **Bernard H. Varnau and Truman B. Wayne,** of Sugar Land, Texas, U.S.A. 1,715,049; patented May 28th, 1929; filed September 4th, 1926; serial No. 133,594.

The principal object of this invention is the production on a commercial scale and by methods which are economically feasible, of an extra fine crystalline sucrose sugar of a texture resembling the ordinary commercial "soft" sugars, but of a purity much higher than the latter and resembling in colour and purity the high grade refined cane and beet sugars of commerce. The method may also be used in the



production of a high grade soft sugar of from 98 to 99 per cent. purity (98 to 99 per cent. sucrose calculated on the basis of dry substance) from syrups and liquors which are not of sufficient purity for the production of the very highest grade of white sugars. The inventors have found that by making quite a radical departure from the usual commercial methods of producing high grade white sugars, a sugar

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*; L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin Germany.

of very close to 100 per cent. purity can be produced having the very small crystals of soft texture characteristic of the soft sugars of commerce now being produced by boiling in vacuum pans, but of much higher purity than the latter. Sucrose of nearly absolute purity has been made for many years in the form of the usual hard granulated crystals, but never, so far as one is aware, on a commercial scale in the form of almost absolutely pure, soft, extra fine, crystals. The inventors have discovered that by rapidly cooling sucrose solutions of sufficiently high supersaturation and purity it is possible by means economically feasible, to produce grain settings of extremely numerous crystals which are uniform enough to allow the production of extra fine sugars of high quality.

In the preferred system of carrying out the process the apparatus shown in the accompanying drawing in diagrammatic form may be used. Liquor or syrup to be made into sugar, produced by concentrating high purity liquors from bonechar or vegetable carbon decolorizing processes, or by melting sugars from previous crystallizations of sufficiently high purity, or from any other source capable of yielding satisfactory liquors, by means which are commercially feasible is run through pipes 15, 19, or 20 to storage tank 16. This liquor will ordinarily have a density of from 80 to 82° Brix at 17·5°C. (but will be correspondingly lighter depending upon its temperature under actual operating conditions) and a temperature of approximately 160°F. A small centrifugal pump 23 having its suction attached to the storage tank then pumps the liquor or syrup through the pipe 24 into the heater 26 where the temperature is raised sufficiently to melt any crystals, or the major portion of them, which may already be present in the liquor or syrup. If the liquor or syrup is practically free from grain, it may be by-passed through pipe 25 directly to the cooling apparatus 27. This cooler 27 must be of suitable design to allow rapid cooling of the syrup to the desired point where a satisfactory grain setting is obtained, and is preferably composed of a motor-driven centrifugal basket 28 which is provided with a scatter plate 29 upon which the hot liquid is projected by the force of the centrifugal pump. The liquor or syrup is finely atomized by the action of being thrown by the scatter plate against the sides of the basket, and from thence against a cooling jacket made of copper surrounded by a water jacket 30 for the purpose of circulating cooling water next to the cooling surface upon which the finely atomized liquor is projected. The rate of cooling is determined by the rate at which the liquor is pumped into the centrifugal basket 28 through the pipe 25 and the velocity and temperature of the cooling water circulated in the water jacket 30. A current of air is drawn through the cooling chamber from below by the fan 31 located at the top of the hood 32. The liquor is thrown out of the basket against the cooling surface, and then runs down the vertical sides of the apparatus and out of the openings 33 into the trough 34. While the inventors prefer this type of cooling apparatus because of the rapidity of the cooling action and the ease with which the temperature of the effluent liquor may be controlled, it is obvious that the same action may be obtained in other types of apparatus which may employ spray nozzles as a means of atomization of the liquor or syrup to be cooled, or through the use of cooling coils furnishing sufficient cooling area to obtain the desired results. However, it has been found that spray nozzles have a tendency to become clogged by small crystals and suspended matter which may be present in the liquors and syrups undergoing cooling, and in using other types of cooling apparatus which do not effect the immediate cooling action obtainable with the apparatus described above, some difficulty is often experienced with some sucrose liquors and syrups due to the formation of irregular grain settings brought about by un-uniform cooling. The cooled liquor which runs out of the cooling apparatus into the trough 34 should have the proper grain setting for the type of sugar which is to be manufactured, and is conducted to the crystallizer 35 which is provided with the agitator 36 to keep the mass in slow agitation until the crystals have grown to the desired size. Water, either warm or cold, may be circulated through the water jacket 37 in order to bring the crystallizing mass to the desired temperature. Ordinarily, this temperature should be maintained between 90 and 100°F. but after satisfactory crystal formation is assured, the operator may reduce the temperature as low as 80°F. or even lower. The condition of the material

will determine how low the temperature may be reduced, the aim being to reduce the temperature as far below the saturation point as possible, in order to obtain a maximum yield and yet not adversely affect the character of the crystals.

The actual temperatures and densities employed will necessarily depend upon the grade of sugar to be produced, and the character of the sucrose solution to be treated. Also, the temperature of the original liquor or syrup will determine the degree to which cooling must be carried in order to get satisfactory grain settings. The temperature of the original liquor or syrup may range between 140 and 212°F., or possibly either higher or lower. This is determined by the source of the liquor and the method of its preparation. If the liquor or syrup is obtained from evaporation of less concentrated liquor under vacuum the lower temperatures will prevail, but if it is prepared by melting of sugar from previous crystallizations it will be necessary to carry higher temperatures in order to get a solution of the required density which is practically free from grain which may adversely affect the purging quality of the massecuite to be formed later. Liquors ranging between 75 and 85 per cent. solids may be used, although the most favourable density is about 80 to 82 per cent. solids, and the method of cooling and handling will have to be altered to suit conditions, both in regard to density and purity of the liquor or syrup being treated. The temperature drop which must be obtained in the cooling apparatus will likewise vary with the type of crystals, whether large or small, to be made, the density of the solution, and the purity thereof. In general, when small crystals are desired, the temperature drop will be greater in order to obtain a thick setting of grain which will later be developed to the desired size in the crystallizer; and when large grain is desired, the temperature drop will be less for the same solution in order to obtain a less dense setting of grain which may then grow to the desired size in the crystallizer. Likewise, when the solution is lighter than the most favourable density (80 to 82 per cent. solids) greater temperature drops are necessary because the saturation point is lower for lighter solutions. With solutions of lower densities and lower purity, crystal formation is more difficult to control, and the process of "seeding" can be employed to advantage in order to introduce more of the solid phase and make it dominant over the other factors of temperature, density, and purity in determining the growth and character of the crystals. This we prefer to do by introducing a quantity of magma from a previous crystallization which possesses the proper crystal characteristics, the quantity ranging between 1 and 10 per cent. depending upon what is found by experience to produce best results for the solution being treated, and this magma is best introduced into the hot solution and thoroughly mixed just before being pumped to the cooling apparatus 27. Obviously, since the temperature drop and temperature of the cooled liquor or syrup are dependent upon the purity, density, and temperature of the original liquor or syrup, it is impossible to disclose exactly what temperature drops must be obtained in a general way for all solutions to be treated. The controlling factor is the grain setting to be obtained, which any one skilled in the art of crystallizing sugar can determine by examination of the crystal formation when viewed on a glass over a light or other source of illumination. However, we will define, in a general way, these ranges by stating that with original liquors and syrups at 80 per cent. solids and ranging between 140 and 212°F. temperature drops of from 12 to 80°F. must be obtained, and the effluent mass from the cooling apparatus 27 may range betwen 95 and 130°F. or possibly higher when the solution is seeded before cooling and large grained sugar is desired. With solution of very high purity (97·5 to 99·9 per cent. purity) the lower limit of temperature drops is desirable under certain conditions, although drops of from 20 to 50°F. are usually employed.

After the grain setting has been induced in the cooling apparatus 27, the crystallizing magma is further cooled in the crystallizer 35 and maintained at a temperature of approximately 96°F. although this temperature may be varied at the discretion of the operator, until a satisfactory crystal growth is assured, after which the magma may be further cooled to 80°F. or possibly lower, the idea being to get as great a temperature drop below saturation as possible in order to get a maximum

yield, yet without detrimentally affecting the character of the grain. The magma is allowed to remain in the crystallizer from 30 mins. to 6 hours, or in some instances even longer provided adequate crystallizer capacity is available and it is found that the increased yield makes this economically feasible. The high purity magmas remain in the crystallizer the shortest time, and the low purity magmas are kept in slow agitation for longer periods of time. When the crystallizing operation is completed, the magma is run out by gravity, or pumped if necessary into the mixer 38 of the centrifugal machine 39. This mixer is of sufficient capacity to supply a number of machines which are installed and operated in the usual manner employed in centrifuging sugar. The syrup thrown off from the sugar passes out of the centrifugal machine through the pipe 41 and may be diluted and heated to melt fine grain, and then pumped back to storage tank 44 from which it may be sent to vacuum pans or multiple effects for concentration for use in extracting further sugar by re-treatment by the present process, if its purity and density are satisfactory, or may be boiled into further strikes of sugar in the vacuum pans. As the present process is not applicable or intended for use in the extraction of sugar from low purity syrups, it is best used in conjunction with the vacuum pan process of boiling sugar, the latter being used after the purity and other characteristics of the syrups are not favourable for the production of sugar by the present process. In regard to re-treatment of mother liquors from the first crystallization, this can be done by diluting and heating them in a small tank as they are discharged from pipe 41, pumping back to storage tank 44, and then re-concentrating to 80-82 per cent. solids in vacuum pans. The concentrated liquor so obtained may then be subjected to the treatment described above in order to obtain a second drop of crystals, which, if not of sufficient purity for use as first sugars, may be remelted and the resulting liquor mixed in with a fresh batch of liquor and allowed to undergo treatment as described above. If the grade of sugar manufactured by the present process is manufactured in conjunction with sugars of the ordinary commercial types it will be found convenient to omit successive re-treatments; after diluting and heating the mother liquors they are supplied to vacuum pans for further sucrose extraction by the usual methods of boiling to grain in partial vacuums.

CONFECTIONERY. (*A*) **Charles E. North** (assignor to **Dairy Drink Co.,** of Chicago, Ill., U.S.A.). 1,710,503-1,710,508. April 23rd, 1929. (*B*) **Hobart W. Harper,** of La Crosse, Kans., 1,711,599. May 7th, 1929. (*C*) **John W. Trauger and Clarence J. Smethers** (assignors to **Fair Play Caramels, Inc.** of New York, U.S.A.). 1,719,635. July 2nd, 1929.

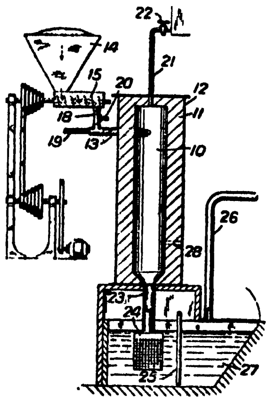
(*A*) These processes concern the manufacture of a beverage containing in addition to cocoa and milk, agar, vegetable gum, gelatin, etc., with application of heat, the object being "to increase the viscosity of the liquid to such an extent that by its friction on their surfaces the cocoa fibres remain in suspension." (*B*) The combination with a base, and upstanding supporting means thereon at the sides thereof, of a tank supported by the base between said upstanding means, oppositely disposed strips hingedly connected to said supporting means and separately insertable to position over the tank, there being a longitudinal series of apertures in each of the strips, yielding retaining means supported in an inclined position adjacent each of the apertures, sticks insertable through the respective apertures into frictional engagement with the ends of the retaining means, said means pressing the sticks laterally to bind them against opposed portions of the wall of the aperture in which they are seated, confection supporting discs carried by the sticks, spacing devices on each strip for holding the discs away from the strips, said sticks and discs being invertible with the strip thereby to support an engaged confection within the tank, and a disc holding pocket on the base beyond one end of the tank, said pocket including opposed upstanding walls and a centring pin. (*C*) An article of manufacture comprising a container consisting of a body portion, impaled pieces of confection packed side by side in said portion with the impaling means extending above the body portion, and a free cover telescoped over the body and supported upon said impaling means.

METHOD OF INCREASING SUGAR CONTENT OF SUGAR SOLUTIONS. **Walter H. Dickerson** (assignor to the **Industrial Waste Products Corporation**, of Dover, Del., U.S.A.). 1,713,118. May 14th, 1929. Claim is made for the method of recovering in substantially dry powder form the solid content of a sugar solution which contains sucrose and invert sugar and at the same time obtaining in the powder product a ratio of sucrose to invert sugar which is substantially greater than the ratio of sucrose to invert sugar in the initial sugar solution, which comprises spraying the sugar solution into a hot drying gas, effecting a reduction in the temperature of the sprayed material by the time drying thereof is substantially completed to a value at which the product is not injured, and collecting the powder product.—EFFECTING A REACTION BETWEEN SUCROSE AND LIME. **Ralph W. Shafor**, of Denver, Colo., U.S.A. 1,713,925. May 21st, 1929. A precipitate of lime and sucrose is produced in the manufacture of sugar by first effecting in a series of steps a continuous reaction of lime and sucrose solution to the point of concentration of the lime at which the alkalinity approaches a maximum point as the reaction is completed, and then effecting in a series of steps the reaction of the product of the first reaction with lime to produce the precipitate of lime and sucrose, the material in the second reaction being kept from back mixing with the material in the first reaction.—BEET TOPPING MACHINE. **Stanley F. Parker**, of Milwaukee, Wis., U.S.A. 1,714,617. May 28th, 1929. In a beet-topper is claimed the combination of a power driven assembly supported upon a portable framework comprising : a transverse ground-contacting forward roller ; a transversely reciprocative cutting blade ; adjustable means for fixedly regulating the relationship between the said roller and said blade ; resilient means for cushioning a common vertical freedom in the aforesaid roller and blade ; a circular ground-sweeping brush behind and spacedly separate from said blade ; said brush adapted to rise and fall independently of the roller and blade in accordance with the beet-row harvested ; and singular means for lifting, in unison, the said roller, blade, and brush into an inoperative position.—BEET DIGGER. **Paul Raoult**, of Liège, Belgium. 1,714,889. May 28th, 1929. In a digger, the combination is claimed of a digging frame, a wheeled axle supporting the rear end of said frame, share-carrying standards, lower and upper shafts connecting said standards, the ends of the lower shaft being oppositely threaded and fitted in the standards for varying the distance between the latter, a slotted yoke receiving said lower shaft, a screw fitted in said yoke, and means for turning said screw for varying the height of said standards.—SUGAR BEET HARVESTER AND TOPPER. **John G. Dick**, of Chinook, Mont., U.S.A. 1,715,823. June 4th, 1929. In a beet harvester, the combination is claimed of a downwardly and forwardly inclined frame having ploughs at the front end for loosening the soil about the beets, means in rear of the ploughs for elevating the beets while maintaining them in upright position, longitudinal sills in rear of the elevator, a gauge bar at the side of one sill, a topping knife at the rear end thereof, rotary means for tipping the beets laterally toward the gauge bar, and means for conveying them rearwardly and at the same time gradually urging them against the gage bar.—PRODUCTION OF CELLULOSE AND PAPER FROM STRAW, ESPARTO, REED, AND SIMILAR MATERIALS. **Erik L. Rinman**, of Djursholm, Sweden. 1,716,006. June 4th, 1929. A method of producing cellulose from straw, esparto, reed and similar raw materials consists in subjecting the raw material to boiling with caustic soda lye at a temperature not exceeding 140°C. whereby the glutinous substances present in the raw material are not destroyed but are capable of being utilized in the production of paper from the cellulose obtained, and separating the waste liquor from the cellulose after the boiling is completed at a temperature not exceeding 50°C. whereby the glutinous substances are not dissolved from the cellulose.—CONTINUOUS FILTER THICKENING APPARATUS. **A. L. Genter**, of Salt Lake City (assignor to **Genter Thickener Co.**, of Delaware, U.S.A.). 1,716,040. June 4th, 1929. In an apparatus for filtering and thickening mixtures, claim is made for a plurality of filter elements submerged in the material to be thickened and disposed in a plurality of banks of parallel rows of elements arranged about a filtrate receiver located centrally thereof, means for applying suction to the receiver to effect filtration, connexions between the filter elements and the receiver, means for removing filtrate from the receiver, and means for collecting the thickened material.

UNITED KINGDOM.

PRODUCTION OF ACTIVATED (DECOLORIZING) CARBON. **W. M. Williams,** Southgate, London; **R. S. Claytor,** of Littleover, near Derby; **Sir J. P. Fry,** of Great Ayton, Yorks., and **A. R. Harper,** of London. 310,908. February 1st, 1928.

Active carbon is produced from bituminous coal or other carbonaceous material which will evolve combustible gases when heated by injecting the powdered material with a limited quantity of air into a retort at a temperature of about 800°C. or over, e.g. 800-1000°C., the material being partially burnt and being maintained in the products of combustion until it is activated. The retort may be of elongated form and circular cross-section and may be vertically or horizontally disposed. The material which may be coal dust or other cheap material may be injected tangentially. The walls of the retort are preferably lined with magnesite or other refractory material promoting surface combustion. Acid may be added to the raw material or directly to the retort to render the atmosphere acid during the activation. The result obtained may be controlled by varying the air, combustible gas and the powder supplies, and the pressure within the retort. To obtain more intense combustion the air supply may be preheated and a second air blast may be introduced into the retort at a point below the first inlet. A steam ejector may be provided to withdraw the treated carbon. In an example, the powdered material is fed from a hopper 14 by a screw conveyor 15 into a tube 18 from which it is injected by compressed air, supplied through a pipe 19, through a pipe 13 tangentially into the retort 10. Combustible gas may be introduced through a pipe 20. The retort comprises a metal casing 12 lined with firebrick 11. Acid may be introduced through a pipe 21 and a regulating cock 22. The activated carbon is withdrawn through an opening 23 and is distributed by a rose 24 in water in a tank 27 from which it is removed by suction through a pipe 25 to a filter-press or other separating device. The residual gas which consists largely of carbonic oxide escapes through a pipe 26. The carbon may be cooled or quenched as soon as activation is completed by introducing a water spray at a suitable point 28 in the retort. In one form, the coal dust is introduced with air and coal gas into the retort which has previously been heated to bright red heat by burning coal gas therein. The residual carbon is washed in dilute sulphuric acid, dried and retreated. In another form in which the activation is effected in one operation, hydrochloric acid is introduced directly into the retort and no combustible gas used after the preliminary heating. (Specifications 206,862, 228,582, and 228,954 are referred to). The provisional specification describes a preliminary carbonization step in which when the retort is sufficiently heated the supply of combustible gas is shut off.



CONFECTIONERY. (*A*) **O. Kremmling,** of Hamersleben, Germany. 308,469. March 19th, 1928. (*B*) **C. Magat,** of Paris. 308,552. September 28th, 1928. (*C*) **A. Hanns and E. Romer,** of Leipzig, Germany. 309,046. April 3rd, 1929; convention date, April 3rd, 1928. (*D*) **A. G. Rose and Rose Brothers (Gainsborough) Ltd.,** of Gainsborough. 309,111. January 4th, 1929. (*E*) **E. Oppenheim,** of Brunn, Czecho-Slovakia. 309,601. April 11th, 1929; convention date, April, 12th, 1928. (*F*) **J. Hounsell (Engineers) Ltd., W. Hounsell, and F. Hounsell,** of Birmingham. 309,742. April 19th, 1928.

(*A*) In a brushing-machine for coating, glazing, brushing, and otherwise treating edible wares such as confectionery and sweetmeats, a rotary or band brush is used which is reciprocated transversely to the direction of the feed movement of the confections, or, alternatively the conveyor may be reciprocated or moved bodily in a circular or elliptical path, these movements being superimposed on the general feeding movement. (*B*) A food giving the sensation of cold when being consumed

is made by intimately mixing together melted vegetable fat, e.g., cocoa-butter, and chocolate, and cooling the mass as obtained quickly by contact with ice. 11 lbs. of ground chocolate, made from cocoa, cocoa-butter, sugar and fecula, may be cooked in 13·2 to 15·4 lbs. of cocoa-butter on a water bath at a temperature not exceeding 86°F.; after cooling to 68°F. the mass is poured into moulds and then cooled with ice to congeal the fat quickly. (*C*) A bon-bon moulding machine of the type wherein a pair of co-acting cutter discs act upon a string of material is furnished with a mould disc disposed alongside one of the cutter discs and associated with a pair of rotary plunger holders furnished with plungers of which one set transfers the severed portions of material to the mould apertures and ejects the moulded sweets therefrom. (*D*) Relates to machines, for wrapping caramels and the like, and in which receiving pockets on an intermittently moving wheel, endless chain, or oscillating arm, are brought opposite a pusher which thrusts the metal strips extending the whole length of the member (as described in Specification 264, 626). (*E*) For making chocolate or other confectionery rich in vitamins, the finished but still plastic mass is allowed to cool to a considerable extent and is then exposed to the action of ultra-violet rays while being stirred, or spread in a thin layer, or subdivided as by spraying. (*F*) Apparatus for cutting or marking toffee, etc., comprises a carriage movable on wheels or rollers above a cooling table and carrying a plunger or plungers for applying pressure to a cutting or marking frame disposed on the mass on the cooling table.

Improvements in the Distillation of Alcohol and other Substances. **A. Freymann**, of Berlin, Germany. 310,400. January 25th, 1928. In distilling and rectifying alcohol and other substances, the mixture of liquid and vapour issuing from the still, etc., is caused to pass through a chamber on its way to a condenser, compartments within the chamber being connected so that the condensate flows through them and is heated by the mixture so as to expel constituents of low boiling point.—Production of Glucose by Saccharification of Cellulose. **International Patents Development Co.**, of New York (assignees of **C. Hagen**, of Chicago, Ill., U.S.A.). 310,924. March 11th 1929; convention date, May 3rd, 1928. Starch is converted to glucose by passing an acidulated starch magma continuously under pressure from a pump through conduits of considerable length but relatively small diam., surrounded by a heating fluid such as high pressure steam in containers. The starch from a storage vessel is first gelatinized in tanks used alternately by steam from the converted liquor. The parts of the apparatus which come in contact with the starch magma are composed of a material such as glass, which is catalytically inert with respect to the conversion reactions.—Saccharification of Cellulose. **Distilleries des Deux-Sèvres**, of Melle, Deux-Sèvres, France. 311,695. January 22nd, 1929; convention date May 14th, 1928. Completely dried cellulosic material, either pure or mixed with other products, is treated with anhydrous or highly concentrated formic acid in the presence of a small quantity of catalyst acids or salts such as sulphuric, hydrochloric, phosphoric, sulphurous, benzenesulphonic or toluenesulphonic acid, or chloride of zinc, calcium or iron or bisulphates, and the formates obtained are hydrolysed directly in a sufficiently concentrated formic medium, by the progressive addition of a small quantity of water whilst assisting the reaction by stirring and heating. The hydrolysis is completed by boiling the sugars and dextrins in aqueous solution in the presence of a mineral acid, with or without pressure. The cellulose if in the form of wood may be given a preliminary treatment with dilute solutions of mineral acids to convert it more or less thoroughly to hydro-cellulose and convert pentosans into pentoses which may be eliminated and converted into furfurol. Examples are given of the treatment of paper pulp and sawdust. The formic acid is recovered by distillation in the presence of a liquid forming therewith an azeotropic mixture, or by distillation in the presence of an alcohol giving with the formic acid a volatile formate, which is subsequently saponified, or by bringing the formic acid into aqueous solution with the sugars, and extracting it by methodical exhaustion in counter-current by means of solvents insoluble or but slightly soluble in water.

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to July 20th	2,257,550	..	1,907,573
Deliveries „ „	1,961,739	..	1,654,873
Meltings by Refiners „ „	1,757,925	..	1,515,750
Exports of Refined „ „	57,000	..	52,984
Importers' Stocks, July 20th	394,042	..	361,240
Total Stocks, July 20th	662,580	..	515,059
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT JUNE 30TH.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	2,238,221	..	1,846,529	..	2,825,662
Stocks	1,156,430	..	1,157,428	..	1,298,387
	3,394,651		3,003,957	..	4,124,059
Local Consumption..	66,000	..	49,119	..	42,223
Receipts at Ports to June 30th ..	3,460,351	..	3,053,076	..	4,166,272

Habana, June 30th, 1929. J. GUMA.—L. MEJER.

Beet Crops of Europe.

F. O. Licht's Fourth Estimate.

	1929-30 Hectares.		1928 29. Hectares.		1927 28. Hectares.
Germany	430,000	..	429,099	..	406,739
Czecho-Slovakia	228,000	..	250,475	..	281,321
Austria	30,000	..	27,677	..	23,529
Hungary	73,000	..	65,503	..	62,353
France	250,000	..	237,800	..	230,425
Belgium	60,000	..	63,217	..	71,380
Holland	54,000	..	65,255	..	69,002
Denmark	30,000	..	41,200	..	39,700
Sweden	24,000	..	42,621	..	40,555
Poland	252,000	..	230,385	..	198,032
Italy	120,000	..	112,849	..	93,240
Spain	80,000	..	84,000	..	65,000
Roumania	36,000	..	52,000	..	72,500
Bulgaria	20,000	..	17,000	..	19,400
Switzerland	2,000	..	1,600	..	1,600
Russia	784,000	..	769,000	..	640,000
Great Britain and Ireland	99,000	..	77,300	..	100,247
Other Countries	78,000	..	77,573	..	68,749
Total.............	2,650,000	..	2,644,554	..	2,483,772

United Kingdom Monthly Sugar Report.

Our last report was dated July 10th, 1929.

During the month under review sugar prices again recovered to their former high levels. The most important feature to report was the decree signed by the President of Cuba to establish a single selling agency for the disposal of the balance of the present crop unsold after August 31st, and also of the whole of the 1930 production.

The result of the Brussels Conference is still in abeyance, awaiting the intention of Java which, although a favourable attitude is indicated, is not as yet finally confirmed. This uncertainty helped to unsettle the market and sentiment was again shaken by excellent crop reports on the Continent and estimates of ample supplies of sugar to cover the requirements of the United States. In the absence of any fresh "bullish" features the market, lacking support, gradually dropped away, and at the time of writing a full 1s. of the rise has been lost on the London Market and about 20 points in New York.

On the London Terminal Market the Raw section has been active. Dealings in August have taken place for 8s. 6d. to 9s., and down again to 8s. 1½d. December from 9s. 1½d. to 9s. 6d., to 8s. 5¼d., March from 9s. 4½d. to 9s. 9d. and 8s. 9d., and May from 9s. 8¼d. to 10s. 0¾d. to 9s. 0¾d.

In the White section business has been chiefly confined to the liquidation of outstanding engagements, and in view of the purely local character of the contract dealings are restricted and prices are nominal.

The latest prices are :—

	AUGUST	DECEMBER	MARCH	MAY
Raw	8s. 1½d.	8s. 5¼d.	8s. 9d.	9s. 0¾d.
White..........	10s. 9d.	11d. 5¼d.	11s. 9d.	12s. 0d.

In actual sugars dealings were disappointing and the British Refiners' prices are 3d. per cwt. lower on balance since our last report, they having raised their prices 3d. per cwt. to 24s. net on July 18th and reduced them 6d. per cwt. on August 7th to 23s. 6d. net.

The "Pool" Syndicate increased their idea of the price of Cuban 96 per cent. and indicated a price of 10s. 9d., but buyers remained aloof. Absence of sales soon caused a revision of value down to the neighbourhood of 9s. 6d., but even at this price no interest is forthcoming. In the meantime second-hand parcels for August and September were available at 9s. Java Browns were sold at a parity of 9s. 4½d., c.i.f. Canada.

News of the growing crop in Europe now comes to hand. F. O. Licht reports favourably on the results so far ascertained. The weather is chiefly good in the various beet areas, his estimate of which is generally unaltered.

21, Mincing Lane,
London, E.C.3.
14th August, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 369. SEPTEMBER, 1929. Vol. XXXI.

Notes and Comments.

The Outlook.

With the holiday month intervening in Europe and America, there is little fresh to report with regard to the international sugar negotiations. Rumours and counter-rumours as to Java's intentions have not been lacking; but so far no definite statement as to her decision has been forthcoming. Licht probably sums up the position correctly in pointing out that, since the last meeting at Brussels some weeks ago, new general meetings have not been held; there have been some particular negotiations but without any substantial result so far. The next month or two should, however, bring us reports of further general meetings. Meantime, it is considered that Java's present reduced crop, which looks like not exceeding 2,900,000 tons instead of the first expectations of 3,200,000 tons, increases the chances of an understanding being arrived at.

Cuba has from the beginning of this month instituted a single selling agency for the unsold balance of her 1929 crop (said to be from 500,000 to 800,000 tons according as to whether hedged sugars are recognized or not) as well as for the whole of her 1930 output. The precise character of this agency is described further on; for the moment, it may be said that it implies entrusting to one body the marketing of between four and five million tons of sugar, which is easily a record in sugar annals. The Java Producers selling agency by comparison only deals with 2¾ million tons.

As M. Golodetz remarks in a recent Market Circular, this "marketing of a sixth part of the world total sugar production by one single organ means an endless series of duels fought, not at all with the ultimate consumers, but with the intermediate stages of distributors and manufacturers; with manipulators on influential terminal markets who for reasons of their own desire the market to go lower; last but not least with tactics of other producers who may pursue a different policy." The Cuban authorities have thus set themselves a very difficult task. One object they will doubtless aim at will be the securing in the United States of the Cuban preferential rights, which amount at present to 44 points and under the proposed new tariff may advance to 60 or even more. But what measure of success thay can hope for is a matter of diverse opinion in world sugar circles. The attempt will at least be watched with interest.

The thrashing out of the new American tariff proposals continues at intervals, and one suggestion after another appears to be advanced only to be rejected. In place of the original proposal for a fixed tariff on sugar, one involving a sliding scale was put forward by certain parties, but this met with general opposition and the idea has since been abandoned, the latest news being that the Finance Committee is recommending a maximum duty for Cuban sugars of 2·20 cents. What seems probable is that nothing definite will be known as to the final shaping of these tariff changes till Congress meets again in December.

WILLETT & GRAY'S latest World Crop figures show an estimated increase in the world's production that is higher than a few months since. These statisticians put it, as compared with 1927-28, at 1,761,112 tons increase. A noticeable figure is that of Formosa which, at 900,778 tons, shows an increase in two seasons of some 75 per cent. Elsewhere in this number we give a long but very interesting account of the sugar industry in that Japanese dependency from the pen of A. H. ROSENFELD, who seized the opportunity of being in the Far East for the Java Technologists' meeting last June to call at Formosa, and, armed with exceptional introductions, was able to see the agricultural side of this industry to a degree and with a wealth of detail that no previous visitor appears to have achieved. The result is a valuable account of Formosa cane agriculture which adds greatly to our knowledge of the sugar industry in that island. It is made clear that the responsible authorities there have left no stone unturned to improve the breed of canes planted, and have practically finished the task of substituting new Java POJ varieties for the older Cristalina canes. This, and not any radical increase in acreage, explains the marked advance in output that has characterized the Formosan sugar production the last few years.

A West Indian Sugar Mission.

The Government has appointed a special mission to visit the West Indies and British Guiana to investigate the state of the sugar industry and to report the result to the Secretary of State for the Colonies, LORD PASSFIELD (better known under his former title of Mr. SIDNEY WEBB). LORD OLIVIER who represented the Colonies in the last Labour Cabinet has been offered and has accepted the position of commissioner in charge of the Mission, and it is expected that the enquiry will start in Barbados in October. The object of the mission will be to consider what improvements can be introduced into the sugar industry in the British West Indies to meet foreign competition and in what way any aid that may be found possible can best be applied with this object. The Government have intimated that they are unable in view of their general policy to consider the granting of an increased preference as a remedial measure, so the remedies will have to be sought along other lines. For some reason or other it was not originally intended to include the Jamaica sugar industry within the scope of the mission; but the West India Committee after consulting official bodies in that island has persuaded LORD PASSFIELD to authorize the inclusion of that island in LORD OLIVIER'S itinerary. The expenses of the mission will be shared by the Governments of the Colonies concerned.

The West Indies are not the only sugar colonies in need of assistance, since Mauritius has also of late been making representations to the home Government. We understand that Sir FRANCIS WATTS, K.C.M.G., is on his way to that island on a somewhat similar mission to the one LORD PASSFIELD is pursuing in the Caribbean.

Notes and Comments.

The Position in Cuba.

One of our correspondents in Cuba, Mr. E. L. Symes, writing at the middle of August stated that weather conditions were continuing favourable for the growing cane crop, with heavy rains in June and normal showers in July and so far in August. The late incidence of the rainy season was still apparent in the size of the ratoons and there seemed no reason to expect a crop greater than previously mentioned or about 4,650,000 long tons of raw sugar. In fact, several new factors have appeared of late that may tend to retard production. Financing of the cultivation and other plantation work is becoming more difficult, especially since the Royal Bank of Canada has announced its withdrawal from active management of 12 mills with a total average production over the past five years of some 200,000 long tons. Five of these units are small and it would not be surprising to learn that some 50,000 tons of this amount may be eliminated due to closing down permanently of the high cost units. These small places would probably have been unable to grind several years ago if they had not been sustained artificially by the bank's ability to absorb its losses. The directors have now decided to concentrate the Bank's efforts on purely banking business and leave the production of sugar to others.

The New Cuban Export Agency.

One reason for this abrupt change may have been the impending governmental interference in the sugar industry which has now culminated in the re-organization of the Cuban Export Corporation. The necessity for this step was mentioned in Mr. Symes' articles in the May and August issues of this Journal.[1] However, it was hoped that this re-shaping of policies would come from within and not need to be ordered by the government. Unfortunately, the Decree bringing about this rehabilitation, signed on July 26th, 1929, is of such a nature that it would appear that the control of the export of all Cuban sugar is to be in the hands of one man, the Government representative on the new Co-operative Export Agency. We have not room to give our correspondent's translation of the Governmental Decree bringing this new agency into force; but the following is the gist of it. The National Sugar Defence Committee in July adopted resolutions authorizing the agency on the grounds that it was "advisable to prevent further harm to the mill owners, cane planters, banks, merchants and labour in general . . . . due to the disorder and lack of agreement in the sale of our sugars." "The extreme crisis prevalent in the sugar industry affects the entire nation and has become worse during recent months so that urgent action is needed." "To remedy these evils this Executive has viewed the situation from an international standpoint in an endeavour to stabilize the World's sugar market." It was therefore resolved that the Cuban Export Corporation, acting as the Co-operative Export Agency, should have exclusive control of the sale of all Cuban sugar. The President of the Defence Committee is designated as the representative of the Executive to act as President of the Co-operative Export Agency, but it is laid down that whenever the resolutions of the Board of Directors affect the smooth operation of the C.E.A. or the international obligations and agreements entered into by the Executive Power with other organizations or representatives of the world sugar industry, the Executive may suspend such conflicting resolutions.

This, our correspondent remarks, is certainly not a voluntary co-operative agency, but a mandate imposed on an almost helpless industry. The for-

[1] *I.S.J.*, 1929, 250, 420.

mulation of the scheme is destined to give to one man the entire control of the coming sugar crop of Cuba. Colonel TARAFA is the President of the National Sugar Defence Committee, and now becomes *ipso facto* president of the newly created Co-operative Export Agency. Ultimately fresh selections will be made for the Directorate, but the decision of the new board will necessarily follow the President's ruling in view of the overwhelming executive powers granted him. Hence the Export Agency would appear to be co-operative only in name and to be virtually the Cuban Government acting through Colonel TARAFA. Doubts are naturally expressed as to whether such an agency will contribute to smooth functioning in the sugar industry of the island. Governmentally engineered interferences with the industry are apt to carry with them a maze of red tape and political wirepulling, and while every one recognizes the desire of the Government to assist the sugar industry, opinion in the latter is dubious as to the wisdom of the new regulations which seem destined to create difficulties in practice such as will need a master mind to overcome. Will Colonel TARAFA be equal to the task ?

The Economics of Marketing.

Mr. SYMES makes some pertinent remarks on the economics of marketing which we cannot do better than give here. The success of any co-operative association, he states, results from the ability of its management to avoid any serious mistakes and to shape its policies in accordance with the most scientific methods. A new economic philosophy has arisen and its principles are applicable to the marketing of Cuban sugar as well as to that of any other commodity. This new economic thought however realizes the difference between "selling" and "marketing" which is something that must now be taken into consideration. Previous to 1922 there were periods when the supply was less than the demand, thus creating a seller's market in which commodities could be sold with little or no effort. This type of selling was agreeable and became the standard that producers used for a guide. The periods of over-supply were not prolonged, and the difficulties and losses sustained in sales during those periods were assumed to be the natural result of the accepted cycle through which all world commodities were supposed to fluctuate. During the past seven years the shortages in the supplies of food commodities have been few and of brief duration, and practically non-existent in the sugar industry. Production has been stabilized so that it is always ahead of consumption, and sugar as a result has been sold on a buyer's market. Simple old-fashioned selling is not effective in such a market, since the recurring cycles of under-supply upon which such a method depends for its profits have been absent. The seller cannot continue to stand behind the counter and exchange his sugar for cash with no regard for the real needs of the buyer. His power of production is now so great that he must now change his methods and study the consumer and find methods to increase his number and capacity to buy. The capacity to consume sugar is inherent in the human race and proper investigation on the part of producers should provide steady markets so that excessive surpluses may be avoided. If the newly created Co-operative Export Agency will undertake the marketing of Cuba sugar with due regard for its responsibilities in increasing *consumer demand*, there is little doubt but that the improvement over old sales methods will ingratiate it amongst those for whom it professes to act. Complete control of the crop marketing should enable it to achieve success with the short crop in prospect.

Desiderata in Plant Breeding.

On another page we have made some extracts from an illuminating address by Mrs. GABRIELLE HOWARD on "The Improvement of Plants." Although research on agriculture is being rapidly extended in many parts of the tropics and in many directions—soil studies, environment, plant physiology, resistance to disease, and so forth—none of these latter is more intimately studied than the possibility of creating new and more productive types of plants. The paper does not of course, specifically refer to the sugar cane; and, indeed, some portions are only applicable to crops propagated by seed. But, none the less, there is much that is of interest to those engaged in raising seedling canes and studying mutations. Mrs. HOWARD's studies in genetics are well known, and her long experience in India, and the character of her studies there, have peculiarly fitted her to assume the attitude of counseller to the many young plant breeders now starting work in the tropics. The more scientific portion of her paper, dealing with the interesting transitional phase upon which the subject of genetics has recently entered, may be dealt with on a future occasion; but, from considerations of space, we have confined ourselves in this issue to summarizing her "practical hints" for plant breeders. There are two equally important factors in successful plant breeding: the evolution of a superior type and its presentation in a suitable form to the cultivator. This latter aspect is carefully analysed and, although what she has to say is primarily intended for Indian surroundings, the general principles are of world wide application. What Mrs. HOWARD has to say as to the policy both of the actual worker and his employer has struck us especially: it is almost exactly the attitude assumed by Germany in her pristine pre-war days. When a Prussian Councillor of State was touring in South India (there was a quite considerable interest displayed by Germany in the English overseas Empire immediately before the war), he made particular enquiries on the Indian system of requiring reports, whether monthly or annual or at other intervals, from the scientific officers to the Government. And he said "We in Germany never ask our experts for reports of their work. We know that if a result is obtained the worker will take the first opportunity of informing us of his success. We give him ample time and facilities according to the nature of the problem, and leave him alone. Of course, he may turn out a failure, and time and money is lost; but that is our fault for we have chosen the wrong man for the job." It is needless to say that we heartily approve of all the recommendations made by Mrs. HOWARD, and are indebted to the Indian Science Congress for having persuaded her to give the Presidential address in the agricultural section.

The Sugar Beet Crop in the United Kingdom.

The official reports on the conditions of the current beet crops in this country stated at the beginning of August that sugar beet on the whole was looking fairly well, but the yield was expected to be slightly under average. Since then the outlook has slightly improved, and an average harvest is forecasted. The amount of sunshine experienced this summer should be reflected in the content to be recorded, but the lack of normal rainfall has retarded growth and if September remains dry it seems bound to affect the tonnage results.

It is generally known that the sugar beet crop being grown this year establishes a record in the history of the industry. It is not, however, realized that this record acreage is also contracted for the growing season of 1930,

which is the season before the State Assistance to the industry is further reduced under the terms of the British Sugar (Subsidy) Act, 1925. The Beet Sugar Factories Committee of Great Britain is informed that in many cases present growers, both in the factory areas and the Committee's (or outside) areas, are desirous of increasing their acreage for 1930, and that there are farmers in all areas who have not yet grown sugar beet, who wish to gain experience of the crop. The factory companies constituting the Committee, having considered how far the capacity of the factories will allow of further acreage being taken, have decided to accept new contracts for the year 1930 for a limited acreage. A one-year contract is therefore being issued on October 1st next by all the factories in their areas, and by the Committee in outside areas, to new growers and also to old growers for additional acreage, the right being reserved to close the lists without further notice.

It would therefore seem that 1930 is to create a fresh record in beet sugar production in this country, and that the factories will be working at approximately full capacity. Nothing has been heard, however, of late of any proposals for erecting further factories, and it may be assumed that the policy of the industry is to mark time with existing factories till the subsidy finally expires. If after that date the industry can carry on unaided, or else is assured of a further more or less permanent measure of protection, the question of extending it may well arise. We have, however, yet to learn the attitude of the present Government towards the industry. That the subsidy will be allowed to run its course to the date of expiry in 1934 seems fairly certain ; but after that, assuming a Labour Government is in office, what will be their attitude towards a by no means inconsiderable section of Home agriculture ?

The Position in Argentina.

According to the Monthly Review of the Bank of London and South America, the cane harvest in Tucuman was in full swing at the end of June following interruptions caused by rain, and the results obtained in the crushing, up to then, were better than expected earlier in the season. There had been some frost during June but the damage done was very little, and given favourable weather conditions the total production for the Province would slightly exceed previous estimates. A new sugar mill, erected at a cost of $2,300,000 paper, including machinery, in Monteros was opened during June. This concern is on the co-operative system, and should greatly benefit cane growers in the surrounding region.

As for the Argentine sugar industry generally, it in common with the rest of the world suffers from excess production, and it is therefore difficult for the Argentine authorities to conciliate both the claims of the growers and the interests of those who crush the cane. A delegation of the former waited on the President towards the end of June for the purpose of asking him to intervene in the prices which they receive for their produce. It is as yet too early to say what steps can or will be taken to remedy the position alike of the growers and of the industrialists ; but it is clear that the situation engendered by low world prices does not make for smoothness in the relation between the two parties.

The latest official estimate of the Java sugar crop for 1929 is as follows : Associated Mills, 2,676,000 metric tons ; Non-associated Mills, 275,000 tons ; total 2,951,000 metric tons, or 2,905,000 long tons. On the "head sugar" basis, this is equivalent to 2,884,000 long tons.

The World Sugar Situation.

Report of the Economic Committee of the League of Nations.

The League of Nations has now issued the report of its Committee of Experts on their enquiry into the condition of the sugar industry. The enquiry shows that the consumption of sugar has been growing since the end of the war at the rate of nearly 4½ per cent. per annum, while production has increased even faster, as compared with a growth of consumption and production for several decades before the war of 3 per cent. per annum.

The outstripping of consumption by production is due largely to the violent stimulus to sugar production, particularly of cane sugar, that resulted from the high prices of the war and immediate post-war period. A concerted policy of production is specially difficult since the conditions of production are widely different for cane and beet sugar. In the opening years of the 20th century beet sugar accounted for more than half the world's total; in 1913 for something less than half, and to-day for about one-third. The continual increase in the consumption of sugar since 1912 has been met almost entirely by the planters of cane. In the course of the decade following the application of the Brussels Convention of 1903 the production of cane sugar increased by some 140 per cent. and that of beet sugar by only about 50 per cent.

The war caused a complete revolution of the world sugar industry and decisively settled the contest between cane and beet in favour of cane. In the present commercial year the production of cane sugar is 8 million tons greater than 1913-1914, while that of beet sugar is about half-a-million tons greater. The simultaneous and unco-ordinated expansion of the two industries has led to excessive output, resulting in a fall in prices and a partial stagnation of the sugar industry. The measures taken by various governments to create, protect or stimulate sugar industries artificially within their frontiers have merely aggravated the crisis.

The report examines the various solutions discussed and notes that the following proposals received a large measure of support from the experts consulted :—

1. That an international agreement between all important producers, or alternatively between producers in exporting countries, should be arranged with a view to stabilizing production for a few years.
2. That an international agreement between all exporting countries and those likely to have an export surplus in the near future, should be arranged with a view to a concerted and rational policy of sale.
3. That a concerted endeavour should be made to augment the sale and use of sugar by means of active propaganda, more especially in Eastern and tropical countries.
4. That the possibility of increasing consumption by lowering excise duties without reducing receipts from this source of taxation should be carefully considered by governments.
5. That a central bureau for the collection and dissemination of information should be established.

The report concludes that the difficulties with which the sugar industry is at present contending may be to a large extent remedied by those responsible for the conduct of business and that the crisis has been aggravated by the independent and unco-ordinated action of many countries to stimulate the production of sugar without considering the cumulative effect of their action on the world situation. Action taken by producers on an agreed plan might render superfluous some of the measures by which the sugar industry is

artificially stimulated in certain countries and so might make it advisable for the states concerned to reconsider their policy and if necessary to discuss the taking of joint action.

The Economic Committee will continue to watch developments in this field carefully in order to be able to give the League Council at any moment information enabling it to "judge whether concerted international action could further the solution of the problems under consideration." Meanwhile, the Council is requested to draw the attention of governments to the desirability of ascertaining whether they can lower their excise duties on sugar so as to increase consumption without adversely affecting their fiscal position.

The Oxford Dehydration Process.

A report has now been issued by the Institute for Research in Agricultural Engineering of the University of Oxford, with a preface by Dr. B. J. OWEN, the Director of the Institute.[1] The 1928-29 campaign has afforded the information for the report, a brief account of which will now be given.

DRYING.

The essential feature of the Oxford process is the high efficiency obtained by mass drying, by which the cossettes are treated in continuous progression on a conveyor band. Illustrations (two drawings) are given of the Oxford dryer, and abrief description of it. During the season named at Eynsham the total beet dried was about 14,000 tons; the rate of drying varied from 7·02 to 8·90 tons of beets per hour; and the coal consumption was 8·13 to 8·58 per cent. beet. Average figures for the campaign for the fresh cossettes are: sucrose, 16·56; water, 74·94; invert, 0·117; invert ratio, 0·703; and purity, 88·77; and for the dried cossettes, sucrose, 64·23; water, 5·32; invert, 0·636; invert ratio, 0·990; and purity, 90·00; the inversion per cent. of the beet being 0·038.

For the drying plant of a 50,000 ton factory, drying at the rate of 20 tons per hour (with four 5-ton dryers), the total B.T.U. necessary to evaporate the water is 41,399,920. The heat available from the exhaust steam, and boiler flue gases is 17,070,720, leaving 24,329,200 B.T.H. to be provided by dryer furnaces. Allowing 5 per cent. loss on combustion, the coal at 13,000 B.T.U. required at the dryer furnaces is 1970 lbs. per hour, which with the coal to generate steam for power, 1456, gives 3426 lbs. of coal per hour, or 7·65 per cent. on beet. A table of costs of the 25,000 tons self-contained factory at Eynsham with the costs for a similar 50,000 ton plant is given, from which, it is stated, the total drying costs work out at 9s. 1¾d. and 5s. 0¼d. per ton of beet respectively.

EXTRACTION, ETC.

The average sucrose in the dried cossettes entering the diffusion battery was 62·7 per cent.; the invert sugar 1·20 per cent.; and the purity, 90·15. Battery losses were: pulp, 0·351; waste water, 0·342; and inversion, 0·060, a total of 0·753 per cent. beet. Following diffusion the juice or rather syrup is heated to 80°C., limed to 7·4 to 7·6 *pH*, and passed through centrifugal clarifiers; after being mixed with a proportion of the re-melted after-product sugar, the syrup is heated to 90°C., treated with a decolorizing carbon, and

1 Bulletin No. 4, entitled "A Report on the Development and Costs of the Oxford Process for the Production of Sugar from Sugar Beet." (Clarendon Press, Oxford). 1929. Price: 2s. 6d. For other articles on the Oxford Process, see *I.S.J.*, 1926, 542; 1927, 145, 657.

filtered. A heat balance of a 50,000-ton plant working according to the Oxford process is given.

In a factory having a capacity of 50,000 tons of beet, and producing 12,500 tons of cossettes the drying plant will require coal at the rate of 7·65 per cent. beet (as above stated); whilst the extraction and crystallization part of the factory will consume 2·88, a total of 10·53 per cent. on beet.

COSTS.

In the case of a 100,000-ton self-contained factory, the total costs (including beet reception, washing, slicing, drying, extraction, carbon revivification, pulp drying, effluent treatment, and special contingencies) amount to 18s. 9½d. per ton of beets, or £6. 13s. 11d. per ton of sugar, which figures after deducting revenue from pulp and molasses and also the subsidy on molasses give final nett sums of 7s. 2½d. and £2. 11s. 4d. These figures are analysed in an appendix showing detailed tables of factory costs for a 50,000 ton self-contained factory, for a 100,000 ton self-contained factory, and for a 100,000 ton extraction factory with two drying stations of 50,000 tons each.

Then in the following tables the final costs are summarized, and the results of working during the two subsidy periods 1928-31 and 1931-34 are indicated :

	1928-31 Per ton Sugar £ s. d.		1931-34 Per ton Sugar £ s. d.
Beet	18 1 10	..	18 1 10
Operating	6 13 11	..	6 13 11
Interest	0 15 3	..	0 15 3
	£25 11 0	..	£25 11 0
Credit for pulp and molasses	2 17 1	..	2 17 1
	£22 13 11	..	£22 13 11
Net subsidy on sugar and molasses	8 8 10	..	1 6 1
Net cost per ton	£14 5 1	..	£21 7 10

The average selling price of sugar during the last five years was about £27 per ton. In the following tables the results of working are shown, with average selling prices ranging from £22 to £27 net :—

	Basis Price of Beet: 46s. per ton. Period 1928-31 £ s. d.		Period 1931-34 £ s. d.
Assumed Net Price realized per ton Sugar	22 0 0	..	22 0 0
Less Net Cost as above	14 5 1	..	21 7 10
Leaving a Net Profit per ton Sugar of	£7 14 11	..	£0 12 2
Representing a return on an Investment of say £275,000 (including Working Capital subject to Reserves, Taxations, etc.).	Per cent.		Per cent.
With Sugar selling at £22 per ton net	39	..	3
,, ,, ,, £23 ,,	44	..	8
,, ,, ,, £24 ,,	49	..	13
,, ,, ,, £25 ,,	54	..	18
,, ,, ,, £26 ,,	59	..	23
,, ,, ,, £27 ,,	64	..	28

It is clear that during the final period 1931-4 some additional assistance would have to be given to the industry should the selling price of sugar remain below £25 as : (1) A lowering of the Excise Duty, which would entail a considerable cost to the taxpayer ; (2) Regulation of the selling price of sugar, the

successful carrying out of which would be attended with great difficulties; (3) A reduction in the factory costs of manufacturing,[1] which at the moment cannot be assessed; and (4) A reduction in the cost of raw beet.

Assuming that the basis price of beet during the final Subsidy Period 1931-4 be reduced to 40s. per ton, the working results for these years would be as follows :—

	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Assumed net price realized per ton Sugar	22 0 0	23 0 0	24 0 0	25 0 0	26 0 0	27 0 0
Less Net Cost	19 4 11	19 4 11	19 4 11	19 4 11	19 4 11	19 4 11
Leaving a net profit per ton Sugar of	2 15 1	3 15 1	4 15 1	5 15 1	6 15 1	7 15 1
Representing a return on an investment of say £275,000 (including working capital) of...	Per cent. 14	Per cent. 19	Per cent. 24	Per cent. 29	Per cent. 34	Per cent. 39

(Subject to Reserves, Taxation, etc.)

In considering this reduced price of 40s. per ton, there seems every reason to believe that, through better technique, more experienced labour, and the improved conditions generally which can be reasonably anticipated, this price will be economic to the grower.

As a saving is made both in manufacturing and transport charges, the price to be paid to farmers, under the Oxford Process, should always be higher than in the case of the Diffusion Process, and this will tend to offset any lowering in the price paid to them for beet. Consequently, when the subsidy has expired, assuming that the Excise Duty remains at its present rate, it should be possible to pay the beet grower a figure not much below what he now receives.

HOME ACREAGE UNDER BEET.—According to official agricultural returns, the area in England and Wales under sugar beet during the summer of 1929 was 229,900 acres, which compares with 175,700 acres in 1928 and represents an increase of 30·9 per cent.

FEEDING SUGAR TO CATTLE.—Evidence is given by W. D. Horne[2] that a larger and more profitable milk production can be obtained through feeding fairly high grade sugar products to cows, the profit per cow per day ranging from 4·7 to 31·5 cents. Second molasses is recommended. The question of the adjustment of protein and roughage in the diet to meet this increased amount of easily assimilated carbohydrate should not prove difficult.

PROPOSED SOUTH AFRICAN DUMPING DUTY.—The South African Government claims the right if necessary to impose a dumping duty on sugar from Germany and Czecho-Slovakia, providing it is satisfied that detriment is resulting to the Union industry from imports of dumped sugar from those countries. The duty is to be equal to the difference between the domestic value of sugar, plus the extra cost of packing and packages for export, carriage to port and all other on-board expenses, and the f.o.b. price at which the sugar is sold by the exporter to the importer.

[1] Many sugar beet factories in England are now engaged in the refining of raw sugars. In the case where the ordinary diffusion factory, operating for four months in the year, is situated on the sea-board, it is possible that it might be economically converted into a refinery. Refining can be introduced with advantage into the Oxford Process, which is particularly adapted to the concurrent production of sugar from dried cossettes and from raw sugars, as only minor alterations or additions to the equipment of a factory would be necessary.

[2] *Facts about Sugar*, 1929, 24, No. 25, 590-291.

A Glimpse of Formosa's Sugar Industry.

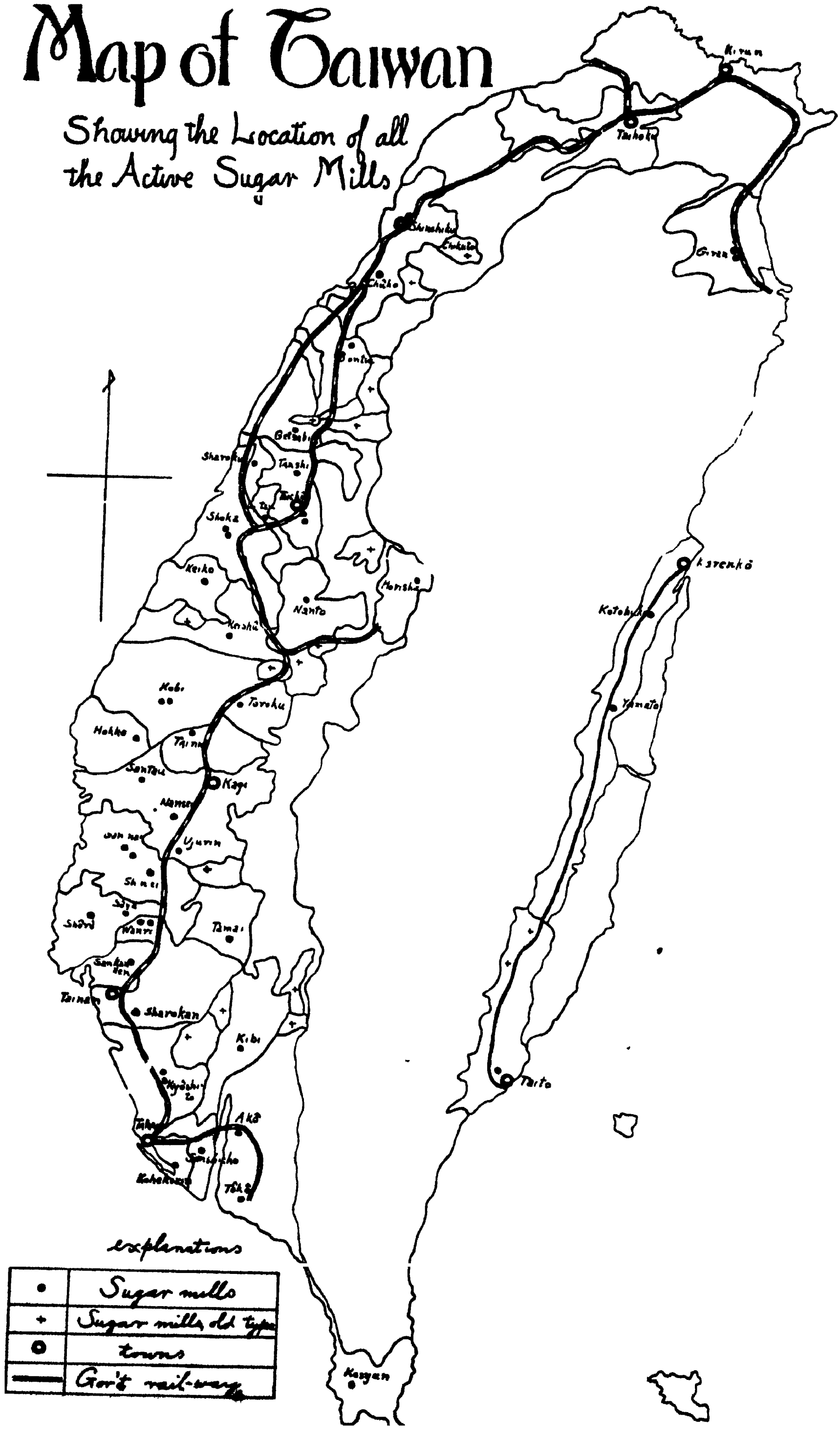
By ARTHUR H. ROSENFELD.
Consulting Technologist of the American Sugar Cane League.

While *en route* to the meetings of the International Society of Sugar Cane Technologists in Java the writer took the opportunity of visiting the beautiful and interesting island of Formosa—or Taiwan, as it is called by the Japanese—the main source of sugar supply for Japan and a country which, from producing practically no sugar when taken over from China by the Japanese through the treaty of Shimonoseki, has in thirty years risen to the point of rivalling the annual sugar production of the Hawaiian Islands. Due to the extreme courtesy of the Government of Formosa, of the Sugar Producers' Association, Dr. Migaku Ishida, Vice-Chairman of the Japan Section of the International Society of Sugar Technologists and Ex-Director of the Formosa Sugar Experiment Station, and, above all, of Dr. Tsutomu Miyake, Plant Pathologist and Acting Director of the Formosan Research Institute, who was detailed by His Excellency the Governor General of Formosa to accompany the writer over the sugar section of the island. it was possible to see the industry in much more detail and obtain many more facts and figures than would have otherwise been possible had the author been dependent upon his own resources. Due to this fortunate fact the writer has thought that it might be interesting to his colleagues who have not had the opportunity of seeing anything of this island so far from the beaten path of travel to have some account, even though necessarily a somewhat superficial one, of its sugar industry.

Location, Topography and Climate.

Taiwan is situated in the Pacific Ocean between longitude 119° 18′ and 122° 6′ East and latitude 21° 45′ and 25° 38′ North, 750 miles southwest of Nagasaki, Japan, and due west of a line extending from Foochow to Canton, China. It will readily be seen from its location that the northern half of the island is sub-tropical, corresponding roughly in latitude to the Tucuman sugar district of the Argentine Republic, although the location at sea level of the northern sugar section does not expose it to the climatic vicissitudes of its South American sister, while the southern half has a location approximately that of the Island of Hawaii, although here again the majority of the sugar lands are at much lower levels than those of Hawaii.

The Island is oval in outline, measuring over 250 miles from north to south and at the widest portion 100 miles from east to west, the total area being 13,880 square miles, roughly four times the size of Porto Rico. The central mountain range preponderates in the east, running north and south, with a vast plain in the west and a much smaller cultivable area along the central half of the eastern coast. On a large portion of this east coast the mountain system borders directly on the sea, forming some of the highest and most precipitous sea cliffs in the world, many of them reaching several thousand feet in height and furnishing a wealth of striking, rugged coast scenery, such as may be seen in few other portions of the globe. Incidentally, the central mountain system has 48 peaks over ten thousand feet in altitude, the highest, *Niitakayama* (known as *Gyokusan* amongst the Chinese inhabitants, who constitute well over 90 per cent. of Formosa's population, and as Mt. Morrison amongst Westerners) rising to a height of 13,000 feet—a thousand feet more than Japan's highest peak, the much pictured Mount Fuji. The Tropic of Cancer passes just south of Kagi, almost in the centre of the island.


Map of Taiwan
Showing the Location of all the Active Sugar Mills
Kirun
Taihoku
Shinchiku
Giran
Nanto
Karenkō
Yamato
Kagi
Tainan
Sharokan
Kibi
Akō
Taito
Koshun
explanations
Sugar mills
Sugar mills old type
towns
Gov't rail-way

A Glimpse of Formosa's Sugar Industry.

The average summer maximum temperature at Taihoku, the capital, at the extreme northern end of the Island, is 36·1° C., the temperature slowly rising as one goes southward along the coast. The central mountain system, according to the altitude, extends over the three zones of torrid, temperate and frigid, and is of course characterized by great variety of climate. In the winter months rainfall is abundant in the north, but in the central and southern portions the winter—and cane cropping—months are generally rather dry and the temperatures springlike. Rainfall varies from 60 to 80 inches per annum. The whole area is very subject to severe typhoons and a considerable portion of the increase in total sugar production in the past three years must be attributed to the unusual absence of destructive typhoons during that period.

Sugar Cane Agriculture.

Rice is the most important agricultural product—and be it said *en passant*, that nowhere in the world, even in Japan or Java, is this crop more intensively grown—followed by sugar cane. The total area of arable land in Formosa is calculated at around 800,000 hectares, of which roughly one-half may be said to be adaptable to sugar cane cultivation. The area actually planted to cane, however, is estimated to be about 120,000 hectares, or about the area at present in cane, in Louisiana, of which probably 20,000 to 25,000 hectares are irrigable.

As hardly any of the companies grows more than about 10 per cent. of its cane supply—the Kohe Kirin mill, which grows all of its supply, being the one outstanding exception to this rule—and almost all purchase around 90 per cent. of the cane going to their mills, the amount of cane planted depends largely upon the independent farmers and these in turn are very largely dependent upon current prices for rice and sweet potatoes. If the prices of the latter commodities are high at planting time the farmer will not plant any more cane than such as he can contract for at a very good price. As rice and sweet potatoes constitute the greater part of the national diet and usually command a fair price, the sugar manufacturer is forced to contract for his cane supply several years ahead and at terms rather favourable to the grower. This fact should be borne in mind when considering Formosa's rather high cost of production.

Usually only one-third of the cane farmers' arable land is in cane, the rest being rotated with rice, sweet potatoes and legumes of various sorts, peanuts, *Sesbania*, soya beans, etc. Hence, in making cane contracts the sugar mill management must arrange for an area of land three times that required for their annual supply.

Until very recent years it was the practice to plant coincidentally with the harvest season from December to May, using the top seed of mill cane, but of late what is known as " early planting," i.e. planting during the wet season from July to December, has become quite general with the almost universal planting of the POJ canes, and " bibits," or seed pieces of two or three eyes each from young cane grown especially for seed, are employed. This means that Formosa has rapidly changed from her 12-14 months' cropping system to the harvesting of cane ranging in age from 18 to 22 months—more along the lines of Hawaii or Peru. There are Government bibit nurseries, which supply cuttings to the sugar plantation companies, which companies in their turn increase this seed supply of the varieties desired in nurseries specially laid out for this purpose, distributing seed from these " bibit gardens " to their cane farmers.

In general it may be said that most of the preparation of the farmers' land, as well as the cultivation, is carried out by hand, the pick, hoe and spade being the principal implements employed. Some of the larger farmers plough their land with the almost universal beast of burden in Formosa, the water-buffalo or carabao, using ploughs of very light draft and the majority of the plantation company lands are broken with carabao ploughs. The writer saw two sets of Fowler steam ploughing tackle in use and a few of the plantation companies use tractors of various makes, mostly American. Cultivation is almost entirely by hand with the farmers, weeds in the earlier stages of cultivation being actually pulled out by hand, as in Peru or Java, and the hoe used for later work. On the company-owned plantations light ploughs and some cultivators are employed in cultivation.

The planting is usually done in rows about 42 in. apart, in quite a lot of cases a modified Reynoso system, as in Java, being used, though shallower planting and flatter cultivation is more general. Occasionally one finds double row plantings, i.e., two rows about 18 in. apart on one bank and then a middle about 5 ft. wide to the next bank. In this case cultivation is carried on only on the outsides of the double rows, no attempt being made to cultivate the narrow middles.

Fertilization is quite general, nitrogen being apparently the main constituent applied, phosphoric acid being employed in much smaller degree, but still being quite commonly employed; potash is seldom used, and where it is employed it is generally in very small quantities and under special conditions on company-owned lands. On these company lands the fertilizers are usually applied unmixed, the main source of commercial nitrogen being sulphate of ammonia, as in Java, although larger quantities of cyanamid and some nitrate of lime are beginning to be employed, in addition of course to the green manures ploughed into the furrows at planting time. For phosphoric acid the double calcium superphosphate is almost universally used, running about 19 per cent. P_2O_5. In general it may be said that 30 to 40 kg. of nitrogen and 20 to 25 kg. of phosphoric acid are applied per hectare—a much lighter ration than those of Hawaii or Java.

For the farmers' cane the companies usually buy mixed fertilizers and distribute them amongst the farmers at the proper time, the actual—and entire—cost being deducted from the payment for cane, a system very similar to that quite generally employed in the Philippines.

Ratoons are little grown, not over 20 per cent. of the plant crop being allowed to go into ratoons anywhere—and this only in certain rather limited sections—and anything beyond first ratoons being decidedly a novelty.

On account of this fact harvesting in the manner usual in Java—i.e., digging the entire stool out with a pick-crowbar and cutting the cane right at the juncture with the mother plant—is quite the usual thing.

VARIETIES.

It was a matter of considerable surprise to the writer and will doubtless be to most of his readers to learn that the *Saccharum sinense* group of canes so characteristic of Formosa a couple of decades ago has practically entirely disappeared from commercial cultivation on the Island. Where this type of cane is still grown on the poorest, shaliest and steepest hillsides it is largely for the consumption of the few remaining native mills which altogether produce around 13,250 tons of muscovado type sugars. *Yon Tan San*, the most largely cultivated of this group, for example, was for the 1927-8 crop grown on less than 5,000 out of the 262,000 acres harvested, less than 2 per cent., whereas

it is estimated that out of the 290,000 acres of cane grown for the 1928-9 crop, just about 3000 acres, or around 1 per cent. carry this once much-used variety. Probably another 9000 acres, roughly 3 per cent. additional, are devoted to *Tekcha* and other "native" or *sinense* canes.

As the Japanese began to build up the Formosan sugar industry they immediately began to look for canes of a better type than the *sinense* group and they at first turned to Hawaii for aid in this respect. Rose Bamboo, or Cristalina, was introduced and for many years or until sereh disease (probably introduced with later importations of B 247, EK 28 and DI 52 from Java) made its cultivation unprofitable, was the most largely grown noble cane. For the 1928-29 crop I have figures showing that there are only about 300 acres of Rose Bamboo to be delivered. Sereh and, later, mosaic disease, got in their nefarious work with B 247, EK 28, and DI 52, and the Formosan planters turned, as Argentina and Western Porto Rico and, later, Louisiana did, to the thin-stemmed, deep-rooted, sereh and mosaic-resistant low-numbered POJ varieties, notably 36, 36 (*m*), 105, 161, and 234. In the past five years the thicker-stemmed, more "ennobled" 27 series of POJ canes, 2725, 2714 and 2727 in order of popularity have largely replaced their sturdy, thinner-stemmed sisters until to-day 2725 and 2714 occupy at least 70 per cent. of Formosa's cane area, the former being far in the lead. Now POJ 2878, Java's "wonder-cane," and its sister-cane 2883 are being rapidly extended all over the Island, but it may be confessed here that as in so many other sugar countries visited in the past two or three years by the author, this rapid seed development of these two varieties is based far more on the wonderful record of POJ 2878 in Java than on carefully conducted tonnage tests in competition with the established varieties of to-day. A number of very promising Formosan seedlings, notably F4 and F19 have been developed at the Shinka Experiment Station but are as yet but little cultivated commercially.

To illustrate the rapid replacement of varieties in the last few years a few figures may not be amiss. For the crop of 1926-27 there were only about 500 acres altogether, or about one-fifth of one per cent. of B 247, EK 28 and DI 52, whereas the first and the last do not figure at all in the 1928-29 plantings and EK 28 is grown on less than 60 acres. POJ 36 and 36 (*m*) still had some 34,000 acres in 1926-27, or about 13·7 per cent. of the cane area that crop. For the 1928-29 crop the figures are 7500 acres, or 2·6 per cent. And, last but not least, the very popular POJ 161—and Formosa is the only country in which this variety has made a great name for itself—covered 80,000 acres, or around one-third of the Formosan cane area for the crop of 1926-27, dropped under 25,000 acres, or less than 10 per cent. for the 1927-28 crop, and for 1928-29 there were less than 6000 acres, or about 2 per cent. of the cane area. Such a rapid shifting of varieties is made possible only by the fact that so little ratoon cane is grown.

As a final illustration of this "varietal revolution" in Formosa the writer is going to take the liberty of quoting a few figures kindly given him by Mr. S. Ebi, the exceptionally capable Agricultural Manager of the Dai Nippon group of six factories. On the numerous plantations of this company 30 per cent. of the cane area for 1928-29 was occupied by POJ 2725, but this variety will form 71½ per cent. of the area to be cropped in 1929-30. POJ 2714, on the other hand, seems to be losing in popularity, as it occupied 24 per cent. of the area for the 1928-29 crop, but only 7¾ per cent. will be planted to it for the 1929-30 crop. And finally, the formerly outstanding POJ 161, which for the 1928-29 crop waved over 22 per cent. of the fields, will for the 1929-30 crop be reduced to a proportion of but 12¾ per cent.

Principal Insect Pests and Diseases.

There are three decidedly injurious stalk borers, these being, in the order of their importance, *Diatraea striatalis*, *Chilo infuscatellus* and a species of *Auchozma*. POJ 2725 and 2878 seem particularly susceptible to the attacks of the first two, as well as to *Colletotrichum* Red Rot following severe *Diatraea* infestation, of which more anon. The *Anomala* root-grub, termites and thrips, the latter causing a leaf-twisting similar in appearance to *pokkah bong*, are of economic importance about in the order named. Mealy bugs also do considerable local damage periodically. Larval parasites of *Anomala* and egg parasites of *Diatraea* and *Chilo* are being imported through the Parasite Introduction Laboratory of the Shinka Experiment Station and a coccinellid has been imported from China as a mealy bug predator. Work is also being done at Shinka with ant predators.

As to diseases, Formosa is infected with almost all the cane diseases of other countries, Fiji disease, however, being still "conspicuous by its absence." Mosaic is widespread, but is to-day of little practical importance, inasmuch as almost nothing but the tolerant or semi-immune POJ canes are commercially cultivated. The same remarks will aptly apply to sereh, which still occurs occasionally. *Cytospora Sacchari* is one of the major cane disease problems and leaf scald occasionally attacks POJ 36 and 161 and, judging from the characteristic white leaf markings observed by the writer in a goodly proportion of the POJ 2878 seen by him, may constitute a serious deterrent to the commercial cultivation of that famous variety in Formosa. Several experiment station men and agriculturists told the writer that they were much worried over the apparent susceptibility of POJ 2878 to this dread disease.

Red rot (*Colletotrichum falcatum*), rind disease (*Melanconium Sacchari*), and *Pythium* root rots seem about as prevalent as these diseases were formerly with the noble canes in Louisiana, and *pokkah bong* is also in evidence on some of the POJ canes, here again 2878 seeming rather particularly susceptible. Some ingenious mechanical demonstrations of the softness of the spindle of the POJ 2878, made by Dr. Hazelhof, at the Pasoeroean Experiment Station during the visit of the International Society of Sugar Technologists, would seem to throw some light on this susceptibility.

As mentioned under "Insects," the attacks of *Colletotrichum* following the burrows of *Diatraea* seemed particularly virulent in POJ 2725 and 2878. Watching the harvesting of one large field of POJ 2725 at Kobi on the estate of the Dai Nippon Company, the writer calculated that fully 60 per cent. of the sticks were more or less severely injured by this borer-rot combination, and Agricultural Manager Ebi informed him that he considered that red rot was responsible for the 25 per cent. decrease in yield from the estimate on this particular field. Pineapple disease (*Thielaviopsis paradoxa*), is very evident, also, on both newly planted and heavily bored mature canes.

Downy Mildew (*Sclerospora Sacchari*), rust (*Puccinia uredocuni*) and smut (*Ustilago Sacchari*), are more or less abundant and pernicious at times, while the less important *Marasmius Sacchari* and the usual common leaf and eye spots such as *Helminthosporium Sacchari* are common, but do no apparent serious damage to the POJ varieties currently grown.

Production.

Eleven companies control the forty-eight modern sugar factories of Formosa, their combined daily grinding capacity being around 42,500 short tons of cane. There are still a number of native muscovado-type mills producing altogether under 15,000 tons of low-grade sugars out of the 800,000 ton crop of 1928-29. These are really what would normally be denominated

as but forty factories, as Kobi, Shoka, Kyoshita, Wanri, Gannai, Taichu, Giran, and Taito each have two complete factories side by side. In other words, where, when increased capacity is desired in most sugar countries, the house is simply expanded and new equipment added, in Formosa this end seems to have been frequently attained by the construction of an entirely new and independent sugar house alongside of the old.

Table I shows the factories controlled by the distinct companies, their daily capacity in short tons of cane per 24 hours, the production of each mill in the 1927-28 crop and the estimated production of each for the 1928-29 crop in Formosan *piculs* of 60 kgs. or 132·42 lbs.

TABLE I.

CAPACITY AND PRODUCTION OF FORMOSAN SUGAR MILLS— CROP 1927-28.
AND
ESTIMATED CROP 1928-29.
(1 *Formosan Picul* = 60 *kgs.* = 132·42 *lbs.*)

Company.	Mill.	Capacity 24 hours (short tons).	1927-1928 Crop. Product (piculs).	Yield (per cent.)	1928-1929 Crop Estimated (piculs)
Dainihon	Kobi No. 1	2,464	597,844	11·46	1,211,134
(Dai Nippon)	Kobi No. 2	1,120	324,467	11·18	
	Hokko	1,680	358,774	10·85	581,077
	Toroku	560	149,890	11·42	172,551
	Getsubi	750	195,411	10·71	187,366
	Ujitsu	504	170,384	10·30	169,772
	Total	**7,078**	**1,796,770**	**11·08**	**2,321,900**
Niitaka	Shoka No. 1	840	194,410	10·01	270,857
	Shoka No. 2	1,100	222,523	9·78	
	Kagi	1,344	253,486	11·70	258,649
	Total	**3,284**	**670,419**	**10·53**	**529,506**
Taiwan	Kyoshito No. 1	728	286,965	12·05	374,010
	Kyoshito No. 2	400			
	Kohekirin	1,000	332,464	13·39	350,232
	Ako	3,000	406,316	11·85	597,285
	Toko	700	202,505	12·37	246,935
	Sharoku	1,200	340,571	11·98	376,480
	Wanri No. 1	202	160,763	11·95	479,458
	Wanri No. 2	1,000	—	—	—
	Sankanten	952	342,198	12·14	365,320
	Horisha	336	98,641	11·83	131,515
	Taihoku	560	44,987	9·63	69,882
	Kibi	1,344	138,010	10·80	266,751
	Koshun	392	24,374	10·62	42,132
	Total	**11,814**	**2,377,789**	**12·04**	**3,300,000**
Meiji	Soya	1,000	237,310	11·17	346,700
	Shoro	840	181,150	11·11	305,910
	Ujurin	840	208,527	11·52	250,475
	Nansei	1,120	258,120	11·46	366,490
	Santau	1,850	421,092	10·92	641,750
	Nanto	840	281,816	10·20	314,616
	Keiko	840	291,649	9·61	340,429
	Total	**7,330**	**1,879,664**	**10·75**	**2,566,370**

Company.	Mill.	Capacity 24 hours (short tons).	1927-1928 Crop. Product (piculs).	Yie'd (per cent.)	1928-1929 Crop Estimated (piculs)
Ensuiko	Shin-ei	1,120	323,383	11·52	398,000
	Gannai No. 1	616	381,345	10·86	469,500
	Gannai No. 2	784			
	Kotobuki	560	126,971	11·47	161,300
	Yamato	616	127,372	10·94	193,600
	Keishu	2,184	249,955	10·84	508,400
	Total	**5,880**	**1,209,026**	**11·09**	**1,731,800**
Teikoku	Taichu No. 1	750	399,933	11·28	869,820
	Taichu No. 2	300	142,651	11·37	
	Tanshiken	840	377,153	11·40	
	Shinchiku	728	124,214	10·01	173,401
	Chûcko	616	102,319	10·50	124,645
	Total	**3,234**	**1,146.270**	**11·10**	**1,167,866**
Showa	Giran No. 1	448	138,600	9·13	134,900
	Giran No. 2	840			
	Tamai	470	74,034	10·16	99·750
	Total	**1,758**	**212,643**	**9·46**	**234,650**
Shinko	Sanshicho	952	100,520	9·90	130,000
Shinchiku	Bioritsu	560	40,437	10·54	59,700
Taito	No. 1	392	30,049	11·05	57,630
	No. 2	168			
	Total	**560**	**30,049**	**11.05**	**57,630**
Sharoku	Sharoku	336	65,057	9·79	75,225
TOTAL	48 Mills	**42,786**	**9,528,647**	**11.13**	**12,174,647**
Old Type Mills					about **200,000**

An idea of the rapid development of the Formosan sugar industry since the Island was annexed by Japan can be formed from an examination of Table II, showing hectares under cane, total sugar production and production per hectare in *piculs* (60 kgs. or 132·42 lbs.) and *piculs* sugar produced

TABLE II.

FORMOSA'S SUGAR PRODUCTION UNDER JAPANESE ADMINISTRATION.

Crop Year.	Hectares in Cane.	Total Production Piculs.	Sugar Yield. Per cent. Cane.	Piculs Sugar. Per Hectare.
1902-03	16,526	506,806	7·42	30·7
1904-05	24,977	826,327	7·71	33·1
1905-06	35,158	1,273,884	7·58	36·2
1908-09	39,035	2,038,797	9·19	52·2
1909-10	63,411	3,404,019	10·12	53·7
1910-11	89,445	4,505,647	10·20	50·4
1915-16	114,451	5,351,071	9·97	46·8
1916-17	129,662	7,634,902	9·60	58·9
1924-25	130,372	7,992,330	9·75	61·3
1925-26	123,952	8,332,097	10·43	67·2
1927-28	108,243	9,667,548	11·09	89·3
1928-29	117,409	12,374,647 (est.)	11·29	105·4

per hectare in certain years from the crop of 1902-03, when the first statistics were undertaken, to the present time, including an estimate of the 1928-29 crop.

The fact that in the past three decades there has been a steady increase of about 50 per cent. in the recovery of sugar in the factory and a rise in sugar produced per acre from practically four-fifths of a ton to two and four-fifths tons is eloquent testimony that the great expansion of the industry has not been due to the enormously increased acreage alone.

Table III gives a synthesis of the industrial data of the 1927-28 crop.

TABLE III.

SUMMARY OF FACTORY RESULTS IN 1927-28 CROP.

Per cent.	Highest.	Lowest.	Mean.
Sucrose in Cane	14·47	10·79	12·65
Fibre in Cane	17·88	12·14	14·21
Sucrose Extraction	97·67	89·43	95·35
Dilution on Normal Juice	39·94	8·31	25·24
Purity of Mixed Juice	85·54	78·00	82·28
Exhaust Molasses on Cane	3·98	2·61	3·04
Total Losses	21·05	9·32	13·00
Sugar Bagged on Cane	13·62	8·95	11·23

It will be seen from the above that the average figures are quite creditable ones indeed.

TYPES OF SUGARS AND COST OF PRODUCTION.

Besides the native *muscovado* type sugars, which are produced in quantities something below 200,000 piculs, and the molasses sugars from the final boilings in the centrals, amounting to around a million piculs annually, three main types of sugars are produced in Formosa :—

(1) Raw sugar for the refineries, amounting this year to about 5,000,000 piculs, and polarizing 98-99°.

(2) Direct consumption browns, amounting to about the same quantity as (1) and polarizing about 99·3°, and

(3) Plantation whites, mostly hard, amounting to around 1,500,000 piculs and polarizing 99·7°

The last two types are large-grained and of excellent quality. On account of the necessity of competing with the imported Japanese refined the plantation whites are being turned out with an exceptionally fine colour and brilliance.

As to the cost of production, the writer was supplied from official sources with the following average cost figures for all types of central-produced sugars during recent years, these figures being inclusive of all costs, overhead, etc., except expenses in refunding fixed capital and interest on capital invested. They have been reduced to U.S. cents per pound, taking *yen* exchange at its parity of fifty cents :—

COST OF PRODUCTION PER POUND, 1922-27.

1921-22....4·90 cts.	1924-25....3·92 cts.
1922-23....4·36 cts.	1925-26....4·04 cts.
1923-24....3·97 cts.	1926-27....4·55 cts.

There is a very wide range of variation shown here, for example between the figures for 1921-22 and 1924-25, this being due in large measure to fluctuating contract prices for the large proportion of purchased cane, and in some degree to fluctuations in *rendement*.

INSTITUTIONS FOSTERING THE FORMOSAN SUGAR INDUSTRY.

This brief description of the sugar industry of Formosa would be far from complete were reference not made to the various excellent institutions and organizations stimulating and assisting its scientific and economic development.

Matters relating to official encouragement and supervision of the industry in general are in charge of the " Section of Special Products " of the " Department of Productive Industries" of the Formosan Government, which maintains four bibit nurseries, in various sections of the Island, for the growing and distribution of seed cane of high quality and desirable varieties.

Research work on all phases of production of cane and sugar is conducted by the excellently equipped and efficiently staffed Sugar Experiment Station, or " Shinka Sugar Department " of the Government Central Research Institute. It was the writer's privilege to spend some time at this Experiment Station which is located about six miles from the important southern city of Tainan, and he was much impressed with the efficient work carried on and under way in each of the various departments of Chemistry, Soils, Plant Pathology, Entomology, Biological Control of Insects, Genetics, etc. The library, too, is most complete and the books are very largely in western languages, including bound volumes of practically all sugar, entomological, botanical and agronomical journals. The experiment station occupies 150 hectares of land, has a Japanese technical staff of fourteen and a settlement of around a hundred souls in all. The administration and each department are housed in separate buildings. An interesting feature of the cane-breeding work here is that the Dai Nippon Company owns the Gedaren factory in Java and Mr. SAITO, the Plant Breeder at the Shinka Station, goes to Java each year to make desired crosses of Java varieties at Gedaren, the fluff being shipped to Shinka and the seedlings raised and tested there.

Another interesting and useful institution maintained by the Central Research Institute is the *Kentosho*, or Sugar Inspection Office at Ta Kao, the southernmost port. This is in reality a Sugar Trade Laboratory, and is very well equipped with the chemical, polariscopic and refractometric apparatus, constant temperature rooms, etc., etc.

The new University at Taihoku is another institution which is going to be of great value to Formosa's sugar industry. Only the main building has been completed—and a beautiful and well planned one it is—most of the departments being housed in temporary, but extremely well-arranged structures. Practically all of the department heads with whom the author had the pleasure of coming in contact are recognized scientists who have studied and in several cases carried on technical work abroad. Dr. TANAKA, for example, the head of the Department of Horticulture, is a well-known citrologist who was for many years connected with the U.S. Department of Agriculture.

The " Togyo Rengokai," or Sugar Producers' Association, was organized many years ago for the purpose of protecting and promoting the mutual interests of the producers of sugar. It has its main office in Tokyo and a branch office in Formosa. In addition to this large and useful general organization amongst the sugar producers of Formosa, there are three more specialized organizations, each of which is helping to promote the interests of the whole, to wit ;—" Seito Kenkyukai," or the Society for the Study of the Manufacture of Sugar, " Shosaku Kenkyukai," or the Society for the Study of Cane Cultivation, and " Jozo Kenkyukai," or Zymological Study Society.

International Society of Sugar Cane Technologists.

Uniformity in Reporting Factory Data.

Fourth Communication.[1]

The first regular meeting of this Committee was held at Soerabaja, Java, in June. Altogether about ten hours were spent in discussing Questionnaire No. 1 regarding General Terms and the Control of the Milling Plant (Bulletin Series of the Java Congress, Preprint No. 29A), and the tentative report rendered by the Chairman (Preprint No. 29).

The following countries were represented at these meetings, by the Committee members themselves, or by proxy : Australia, NORMAN BENNETT ; British West Indies, WALTER SCOTT ; Hawaii, W. L. MCCLEERY (proxy) ; India, K. C. BANERJI ; Japan and Formosa, S. KUSAKADO (proxy) ; Java, P. HONIG ; Louisiana, F. W. ZERBAN (proxy) ; Mauritius, LOUIS BAISSAC ; Philippines, E. T. WESTLY (proxy) ; and Porto Rico, M. A. DEL VALLE. There were also present, in an advisory capacity, S. S. PECK, E. C. VON PRITZELWITZ VAN DER HORST, and C. SIJLMANS. F. W. ZERBAN was in the Chair, and K. C. BANERJI volunteered to act as Secretary.

The Committee had the difficult task of reconciling divergent opinions and of finding a common ground. Nevertheless, agreement was reached on most points with surprisingly little discussion. One question on which it was found impossible to reach a definite decision was as to whether relative mill performance figures should be based on the " ideal " values proposed by DEERR, or on the " normal " values used in Java. For this reason it was agreed not to recommend either one of these procedures, but to wait until a comparative study has been made of both systems, in actual factory practice.

The tentative report of the Chairman (Preprint No. 29), as amended during the sessions of the Special Committee, was officially adopted by the Committee on Factory Operation and Control. It will be printed in the Proceedings of the Congress. The terms and definitions finally recommended by the Special Committee, on the basis of Questionnaire No. 1 (Preprint No. 29A), were likewise voted on favourably. They also will be published in the Proceedings.

At a General Meeting of the Congress, the Special Committee was re-appointed, Mr. E. C. VON PRITZELWITZ VAN DER HORST being substituted for Mr. P. C. TARLETON. The conditions under which the committee will carry out the work entrusted to it remain unchanged. It will continue the programme outlined in previous communications, and will also act on any suggestions for amendments to the methods already adopted.

The report of the Committee, as published in the Proceedings of the Congress, deals only with the general principles of the system of milling control voted by the Committee. The Chairman was requested to prepare a detailed control scheme based on the accepted principles. This is presented below, and it is preceded by a list of the general terms adopted, with their definitions.

I.—GENERAL DEFINITIONS.

Explanatory notes which do not form part of the official definitions follow the definition in brackets.

1. *Cane* (Dutch., Riet ; French, Canne ; Spanish, Canna) :—The raw material delivered at the factory, including clean cane, field trash, water, etc. (Note : For determinations of the weight of the cane the chapter on weighing and measuring is to be consulted. The word " soil " found in some of the definitions of cane has been left out, because it is included in the definition of " field trash " (No. 2)).

[1] For previous Communications see *I.S.J.*, 1928, 147, 266, 594.

2. *Field Trash* (D., Met riet ingevoerd vuil ; Fr., Paille ; Sp., Paja) :—The leaves, tops, dead stalks, roots, soil, etc., delivered at the factory with the clean cane.

3. *Fibre* (D., Vezel ; Fr., Ligneux ; Sp., Fibra) :—The dry, water-insoluble matter in the cane.

4. *Normal Weight* (D., Normaalgewicht ; Fr., Poids normal ; Sp., Peso normal) :—The weight of sample equal to that weight of pure cane sugar which when dissolved in water to a total volume of 100 m.l. at 20°C., gives a solution reading 100° of scale when examined in a tube 200 mm. long in a saccharimeter. (Note : The fixing of the 100° point of saccharimeters equipped with the Ventzke scale is to be left to the International Commission for Uniform Methods of Sugar Analysis).

5. *Pol.* (D., Pol. ; Fr., Pol. ; Sp., Pol.) :—The value determined by single or direct polarization of the normal weight in a saccharimeter. The term is used in calculations as if it were a real substance. (Note : Various terms were proposed for this concept before and at the committee meetings, but all had to be rejected for one reason or another. " Polarization " was considered too long, and finally " Pol." was unanimously agreed upon. It is already in use in several countries).

6. *Sucrose* (D., Saccharose ; Fr., Saccharose ; Sp., Sacarosa) :—The disaccharide known in chemistry as cane sugar $C_{12}H_{22}O_{11}$. (Note : The method of determination has advisedly been left out of the definition ; first, because sucrose need not necessarily be determined by double polarization, but methods based on the destruction of reducing sugars may possibly come into use ; and, second, in bagasse and press-cake sucrose is usually determined by single polarization, the difference between pol. and sucrose being negligible).

7. *Brix* (D., Brix ; Fr., Brix ; Sp., Brix) :—The per cent. by weight of solid matter, as indicated by a Brix spindle or other densimetric device.

8. *Gravity Solids* (D., Schijnbaare droge stof ; Fr., Matières sèches apparentes ; Sp., Sólidos por gravedad) :—The weight of solids calculated from the Brix determination.

9. *Refractometer Brix* (D., Refractometrisch Brix.; Fr., Brix refractométrique ; Sp., Brix por el refractómetro) :—The per cent. by weight of solids in solution as indicated by the sugar refractometer, or as derived from the refractive index and reference to tables of equivalent per cent. sucrose and refractive indices. (Note : The refractometer is used for the determination of small grain in molasses, and is also being introduced for pan boiling. For these reasons the above definition has been included).

10. *Dry Substance* (D., Waare droge stof ; Fr., Matières sèches réelles ; Sp., Materia seca) :—The material remaining after drying the product examined to constant weight.

11. *Suspended Solids in Mixed Juice* (D., Vuil in ruwsap; Fr., Matières en suspension dans le jus mélangé ; Sp., Sólidos en suspensión en el jugo mezclado) :—The solids in mixed juice removable by decantation. (Note : It was considered advisable to add the phase " in mixed juice " to the term itself, because " suspended solids " occur also in other products, like molasses, but are then of an entirely different nature. It was also decided not to use the words " in solution " or " insoluble " in the definition, because they give no exact idea about the state of dispersion of the particles).

12. *True Purity*, abbreviated *T. Purity* (D., Waare reinheid ; Fr., Pureté réelle ; Sp., Pureza real) :—The percentage proportion of sucrose in the dry substance.

13. *Gravity Purity,* abbreviated *G. Purity* (D., Reinheid saccharose/Brix; Fr., Pureté Clerget; Sp., Pureza por gravedad) :—The percentage proportion of sucrose in the Brix or Gravity Solids.

14. *Apparent Purity* (D., schijnbaare Reinheid; Fr., Pureté apparente; Sp., Pureza aparente) :—The percentage proportion of Pol. in the Brix or Gravity Solids.

15. *Reducing Sugars,* or *R.S.* (D. Reduceerende suiker, or R.S.; Fr., Réducteurs; Sp., Azúcares reductores) :—The reducing substances in cane and its products, determined as described in the Chapter on Analysis, and calculated as invert sugar. The components of invert sugar are dextrose and levulose. (Note : The term " glucose " is to be avoided, as it may lead to misunderstanding).

16. *Ash* (D., Asch.; Fr., Cendres; Sp., Cenizas) :—The residue remaining after burning off all organic matter. (Note : For details the Chapter on Analysis will have to be consulted).

17. *Non-sugar* (D., Nietsuiker; Fr., Non-sucre; Sp., No-azúcar) :—Brix minus Pol.

18. *Non-sucrose* (D., Nietsaccharose; Fr., Non-saccharose; Sp., No-sacarosa) :—Brix minus sucrose.

19. *R.S. Ratio* (D., Reduceerende suiker-pol. quotient; Fr., Quotient réducteurs-pol.; Sp., Coeficiente azúcares reductores-pol.) :—The percentage ratio between reducing sugars and pol.

20. *R.S.-Sucrose Ratio* (D., Reduceerende suiker-saccharose quotient; Fr., Quotient réducteurs-saccharose; Sp., coeficiente azúcares reductores-sacarosa) :—The percentage ratio between reducing sugars and sucrose.

21. *Pol.-Ash Ratio* (D., Asch quotient; Fr. Quotient salin; Sp., Coeficiente salino) :—The ratio between pol. and ash.

22. *Sucrose-Ash Ratio* (D., Saccharose-Asch quotient; Fr., Quotient saccharose-cendres; Sp., Coeficiente sacarosa-cenizas) :—The ratio between sucrose and ash.

23. *R.S.-Ash Ratio* (D., Reduceerende suiker-asch quotient; Fr., Rapport réducteurs-cendres; Sp., Coeficiente azúcares- reductores cenizas) :—The ratio between reducing sugars and ash.

24. *Absolute Juice* (D., Gemiddelde sap; Fr., Jus absolu; Sp., Jugo absoluto). All the dissolved solids in the cane plus the total water of the cane; cane minus fibre. (Note : It was decided entirely to abandon the term " normal juice," because it has several different meanings at the present time, and its retention would only add to the existing confusion).

25. *Undiluted Juice* (D., Onverdund sap; Fr., Jus non-dilué; Sp., Jugo sin diluir) :—The juice expressed by the mills or retained in the bagasse, corrected for imbibition water. For purposes of calculation it has the Brix of the primary juice (No. 28). (Note : The committee decided to report, for the purpose of comparing milling results, besides the " Milling Loss " also the Java figure " Undiluted juice in bagasse per cent. fibre." This will make it possible after some time to decide which of the two figures is better for international comparisons. It was thus necessary to define " undiluted juice ").

26. *Undetermined Water* (D., Restwater; Fr., Eau non déterminée; Sp., Agua no determinada) :—Cane minus fibre minus total undiluted juice in cane. In its calculation the suspended solids in mixed juice are also considered. (Note : See under 25).

27. *First Expressed Juice.* (D., Eerst, uitgepersd sap; Fr., Jus de première pression; Sp., Primer jugo estraído) :— The juice expressed by the first two rollers of the tandem.

28. *Primary Juice* (D., Voorperssap ; Fr., Jus primaire ; Sp., Jugo primario) :—All the juice expressed before dilution begins.

29. *Secondary Juice* (D., Naperssap ; Fr., Jus secondaire ; Sp., Jugo secundario) :—The diluted juice which together with the primary juice forms the mixed juice (No. 32).

30. *Last Mill Juice* (D., Laatste molensap ; Fr., Jus du dernier moulin ; Sp., Jugo del ultimo molino) :—The juice expressed by the last mill of the tandem.

31. *Last Expressed Juice* (D., Laatst uitgepersd sap ; Fr., Dernier jus exprimé ; Sp., Jugo de ultima presion) :—The juice expressed by the last two rollers of the tandem.

32. *Mixed Juice* (D., Brutto ruwsap ; Fr., Jus mélangé ; Sp., Jugo mezclado) :—The juice sent from the crushing plant to the boiling house.

33. *Bagasse* (D., Ampas ; Fr., Bagasse ; Sp., Bagazo) :—The residue obtained from crushing the cane in one or more mills. Known respectively as First mill bagasse, Second mill bagasse, etc. ; and as Last mill bagasse, or Final bagasse, or simply Bagasse, when referring to the material from the last mill.

34. *Residual Juice* (D., Sap in ampas ; Fr., Jus résiduel ; Sp., Jugo residual) :—The juice left in the bagasse ; bagasse minus fibre.

35. *Subsider Juice* ; characterized as first and second when double settling is practised (D., Dunsap bezinking, or Schoonsap (1st or 2de) ; Fr., Jus déféqué (1er or 2me) ; Sp., Jugo decantado (1st), and Jugo de las cachaceras (2nd) :—The juice decanted from the mud or settlings in the course of the clarification process. If double decantation is practised, the juices obtained in the two operations are further characterized as shown above.

36. *Filtered Juice* (D., Filtersap ; Fr., Jus des Filtres ; Sp., Jugo de los filtros) :—The combined filtrates from the filters. If double filtration of muds is practised the resulting juices are further characterized as first and second resp. (Note : With the introduction of filters other than presses, Oliver, etc., it becomes necessary to omit the word "press" in this term).

37. *Filter Washings* (D., Afzoetsap ; Fr., Lavages ; Sp., Lavados de los filtros) :—The runnings obtained from the filters during the process of washing.

38. *Clarified Juice* (D., Dunsap (naar verdamping) ; Fr., Jus clair ; Sp., Jugo clarificado) :—The juice entering the evaporators.

39. *Carbonatation Juice* (D., Carbonatatie sap ; Fr., Jus carbonaté ; Sp., Jugo Carbonatado) :—The juice coming out of the carbonatation tanks after filtering, but without washing. It is termed "first" or "second," according to the stage of carbonatation.

40. *Filter cake* (D., Filtervuil ; Fr., Tourteaux des filtres ; Sp., Cachaza, or Tortas de los filtros) :—The residue removed from process by filtration.

41. *Syrup* (D., Diksap ; Fr., Clairce ; Sp., Meladura) :—The concentrated juice from the evaporators.

42. *Massecuite* (D., Kooksel ; Fr., Massecuite ; Sp., Masa cocida) :—The mixture of crystals and mother-liquor discharged from the vacuum pan. Massecuites are classified, according to descending purity, as first, second, etc.

43. *Magma* (D., Aangepapde suiker ; Fr., Magma ; Sp., Magma) :—A mixture of crystals and sugar liquor produced by mechanical means.

44. *Molasses* ; First, second, etc., to final molasses (D., Afloop (First to penultimate molasses), Melasse (Final molasses) ; Fr., Égout pauvre (First to penultimate molasses), Mélasse (Final molasses) ; Sp., Miel (First to penultimate molasses), Melaza (Final molasses) :—The mother liquor separated from

the massecuite by mechanical means. It is termed "first," "second," etc., according to the massecuite from which it is obtained.

45. *Wash* (D., Klaarsel ; Fr., Égout riche ; Sp., Lavados de las centrifugas :—The diluted molasses thrown off the centrifugals during washing, and collected separately.

46. *Jelly* (D., Draadkooksel ; Fr., Cuite au filet) ; Sp., Filete :—A boiling concentrated, without graining, to such a consistency that it may be expected to crystallize spontaneously upon standing.

47. *Sugars* (D., Suikers ; Fr., Sucres ; Sp., Azúcares) :—The crystals (including any adhering molasses) recovered from the massecuite, usually in centrifugals. According to local conditions, different types of sugars are produced, to be either shipped or returned to process. (Note : No attempt has been made to define each of the many types of sugars produced, because this is largely a commercial rather than a technical question. The Java Sugar Experiment Station is preparing a publication on this subject).

48. *Seed* (D., Intrekmassa ; Fr., Pied de cuite ; Sp., Pie) :—Dry sugar or magma used as a footing for boiling massecuite.

49. *Shock Seed* (D., Entgrein ; Sp., Semilla) :—Sugar taken into the vacuum pan to induce crystallization.

50. *Imbibition* (D., Imbibitie ; Fr., Imbibition ; Sp., Imbibición) ; The process in which water or juice is put on the bagasse to dilute the juice present in the latter.

51. *Maceration* (D., Maceratie ; Fr., Macération ; Sp., Maceración) :—The process in which the bagasse is steeped in an excess of water or juice, generally at a higher temperature. (Note : According to definition 50, maceration is a special case of imbibition).

52. *Dilution Water* (D., Imbibitiewater in ruwsap ; Fr., Eau de dilution ; Sp., Agua de dilución) :—The portion of the imbibition of maceration water present in the mixed juice.

53. *Juice Extraction* (D., Sappersing ; Fr., Pression ; Sp., Extracción de jugo, or jugo extraido) :—The percentage weight of juice extracted by the mills. In each case it should be definitely stated what kind of juice is referred to and to which basis the percentage relates.

54. *Pol. Extraction* (D., Suikerwinningsquotient ; Fr., Extraction aux moulins ; Sp., Extracción de pol.) :—Pol. in mixed juice per cent. pol. in cane.

55. *Sucrose Extraction* (D., Saccharosewinningsquotient ; Fr., Extraction de saccharose; Sp., Extracción de sacarosa) :—Sucrose in mixed juice per cent. sucrose in cane.

56. *Java Ratio* (D., Factor *f* ; Fr., Coefficient de jus ; Sp., "Java Ratio") :—Pol. (or sucrose) per cent. cane, divided by pol. (or sucrose) per cent. first expressed juice, and the result multiplied by 100. (Note : The Committee decided to define this figure without recommending it for international adoption, because it is only of local importance. In Mauritius and in the Philippines sucrose figures are used, in others pol. figures. In Java the ratio is based on pol. of primary juice instead of first expressed juice).

II.—Control of the Milling Plant.

The Committee decided that the weights of cane and of mixed juice are to be determined directly. Calculation of the juice weight from its volume is not advisable, but is permissible where juice scales have not yet been installed. The Committee recognizes the fact that in a few exceptional cases the weight of the cane cannot be easily determined. In all these cases the factories are urged to state in their reports how the weight of the cane has been calculated.

The Committee also unanimously agreed that an exact scheme of milling control requires the direct determination of the weight of the bagasse, because there are serious objections to all other methods. This problem should be intensively studied and it is hoped that its solution is not far off. In the meantime, two of the indirect methods in vogue for arriving at the weight of the bagasse have been accepted by the Committee. Either the weight of the imbibition water may be determined, directly or from its volume, entrance of extraneous water being carefully guarded against or else the fibre per cent. cane may be determined in representative samples of the raw material. All reports should distinctly state which of these schemes, outlined below under *A* and *B*, has been followed.

It was decided entirely to abandon the term "normal juice" which has created so much confusion in the past, and to adopt NOËL DEERR's term "absolute juice," defined as cane minus (dry) fibre. Thus all the water in the cane is considered as part of the juice, and there is no "undetermined water." The quantity of "undetermined water" naturally varies with the "milling factor" used, and the acceptance of the conception of "absolute juice" has made it possible to do away with either fixed or varying "milling factors."

The Java technologists averred, however, that calculations based on the conception of "undiluted juice," having the same Brix as the primary juice, are simpler than those based on absolute juice, the Brix of which has to be calculated. After discussion, it was agreed to report, among the performance figures, not only the extraction ratio and the milling loss, but also the undiluted juice in bagasse per cent. fibre. This requires only one additional determination, namely that of the Brix of the primary juice. The absolute juice in bagasse per cent. fibre can be calculated in the same manner, with the use of the Brix of the absolute juice. A comparison of the four performance figures mentioned, for several seasons and for several countries, will make it possible to arrive at a final conclusion as to which of them best serves the purpose for which they are intended.

The Committee decided for the present not to recommend any performance figures which express the result in per cent. of a predetermined maximum figure, such as the "ideal" values introduced by DEERR, or the "normal" values in use in Java. However, a further study of these and similar systems is advised. The same applies to imbibition efficiency figures.

The Committee urges the publication by factories in all countries, of data regarding the milling equipment used, such as knives, shredders, crushers, number and dimensions of rollers. grooving, mill openings, speeds of rollers, pressure on rollers, and similar information.

It was decided not to adopt as yet any of the mechanical milling performance figures, like grinding coefficient, tonnage ratio, tonnage fibre ratio, etc., but to recommend a further investigation of this subject. In order to facilitate this study, the Committee will publish a compilation of the figures in use in different countries as a basis for discussion.

The questions of milling equipment and of mill capacities are closely linked with the problem of a unified system of measurements. Now that the Society has officially favoured the metric system, it will be easier to arrive at a definite understanding about these matters.

The Committee is of the opinion that payment for purchased cane, although closely connected with factory control, is of purely local importance, and that this subject is therefore not amenable to an international agreement. This matter should be regulated entirely in accordance with local conditions.

The milling control data selected by the Committee and the official terms adopted for them are given below. It is not considered necessary to present all the terms in four languages, because most of them have already appeared in the general list, or their derivation is obvious. The only exceptions are extraction ratio and milling loss.

In all cases where the expression "pol." appears, "sucrose" may be substituted by those factories which base their control on sucrose rather than pol.

As explained above, two methods for calculating weight of bagasse have been permitted to stand. For this reason items 9 to 15 appear in duplicate, under Scheme A and Scheme B. All the other calculations are the same in either modification.

Obviously, the sequence of some of the arithmetical operations may be altered without deviating from the established principles of the control system. At the conclusion of its work, the Committee will formulate uniform report blanks, and at that time a complete calculating scheme will be devised. An outline of the milling control scheme follows :—

Figures to be directly determined in all cases.

1. Weight of cane.
2. Weight of mixed juice (or calculated from volume).
3. Brix % mixed juice.
4. Pol. % mixed juice.
5. Dry substance % bagasse.
6. Pol. % bagasse.
7. Brix % last expressed juice.
8. Pol. % last expressed juice.

Weight of bagasse, etc., Scheme A, based on weight of imbibition water.

9. Brix % bagasse = 100 times pol. % bagasse, divided by purity of last expressed juice.

10. Fibre % bagasse = Dry substance % bagasse minus Brix % bagasse.

A 11. Weight of imbibition water, determined directly.

A 12. Weight of bagasse = Weight of cane plus weight of imbibition water minus weight of mixed juice.

A 13. Bagasse % cane = 100 times weight of bagasse, divided by weight of cane.

A 14. Fibre % cane = fibre % bagasse times bagasse % cane, divided by 100.

A 15. Weight of fibre = fibre % bagasse times weight of bagasse, divided by 100.

Weight of bagasse etc., Scheme B, based on fibre % cane.

9. Brix % bagasse, same as in Scheme A.

10. Fibre % bagasse, same as in Scheme A.

B 14. Fibre % cane, determined directly.

B 13. Bagasse % cane = 100 times fibre % cane, divided by fibre % bagasse.

B 12. Weight of bagasse = Bagasse % cane times weight of cane divided by 100.

B 11. Weight of imbibition water = Weight of mixed juice plus weight of bagasse minus weight of cane.

B 15. Weight of fibre = fibre % cane times weight of cane, divided by 100.

Juice Figures.

16. Mixed juice % cane = 100 times weight of mixed juice divided by weight of cane.

17. Purity of mixed juice = 100 times pol. % mixed juice, divided by Brix. % mixed juice.

18. Weight of Brix in mixed juice = Brix % mixed juice, times weight of mixed juice, divided by 100.

19. Weight of pol. in mixed juice = Pol. % mixed juice times weight of mixed juice, divided by 100.

20. Weight of Brix in bagasse = Brix % bagasse times weight of bagasse, divided by 100.

21. Weight of Pol. in bagasse = Pol. % bagasse times weight of bagasse, divided by 100.

22. Weight of absolute juice = weight of cane minus weight of fibre.

23. Brix % absolute juice = (Weight of Brix in mixed juice plus weight of Brix in bagasse), divided by weight of absolute juice, and result multiplied by 100.

24. Pol. % absolute juice = (Weight of pol. in mixed juice plus weight of pol. in bagasse), divided by weight of absolute juice, and result multiplied by 100.

25. Purity of absolute juice = 100 times (weight of pol. in mixed juice plus weight of pol. in bagasse) divided by (weight of Brix in mixed juice plus weight of Brix in bagasse).

26. Weight of absolute juice extracted = 100 times weight of Brix in mixed juice, divided by Brix % absolute juice.

27. Absolute juice extracted % cane = 100 times weight of absolute juice extracted, divided by weight of cane.

28. Weight of absolute juice in bagasse = 100 times weight of Brix in bagasse, divided by Brix % absolute juice ; or weight of absolute juice minus weight of absolute juice extracted.

Imbibition and Dilution Figures.

29. Imbibition water % cane = 100 times weight of imbibition water, divided by weight of cane.

30. Weight of dilution water = Weight of mixed juice minus weight of absolute juice extracted.

31. Dilution % cane = mixed juice % cane minus absolute juice extracted % cane.

32. Imbibition water in bagasse % cane = Imbibition water % cane minus dilution % cane.

33. Dilution % absolute juice extracted = 100 times weight of dilution water, divided by weight of absolute juice extracted.

Cane Figures.

34. Weight of pol. in cane = Weight of pol. in mixed juice plus weight of pol. in bagasse.

35. Pol. % cane = 100 times weight of pol. in cane, divided by weight of cane.

Figures used for judging Milling Results.

36. Pol. extraction = 100 times weight of pol. in mixed juice, divided by weight of pol. in cane.

37. Extraction ratio (D., Extractieverhouding ; Fr., Coefficient d'extraction ; Sp., Coeficiente de extracción) :—(100 minus pol. extraction), divided by fibre % cane.

38. Milling loss (D., Verloren suiker % vezel ; Fr., Coefficient saccharose-ligneux ; Sp., Pérdida de molienda :—100 times pol. % bagasse, divided by fibre % bagasse.

39. Absolute juice in bagasse % fibre = (10000 times Brix % bagasse), divided by (Brix % absolute juice times fibre % bagasse).

40. Undiluted juice in bagasse % fibre = (10000 times Brix % bagasse). divided by (Brix of primary juice times fibre % bagasse). The Brix of the primary juice must be determined directly.

If desired, the percentage composition (pol., non-sugar, water) of mixed juice, absolute juice, bagasse, and cane, may be calculated with the aid of the data presented.

M. A. del Valle.
E. C. von Pritzelwitz van der Horst.
F. W. *Zerban, Chairman.*

The Brazilian Cane Sugar Industry:

Notes on the Costs and Profits of Cultivation and Manufacture.

By Dr. FREDERICO W. FREISE, Consulting Engineer.

The following data were collected as the result of an elaborate inquiry made on 160 plants in the Brazilian states of Rio de Janeiro, S. Paulo, Pernambuco and Minas Geraes, where at the end of 1928 some 181 plants of the so-called "complete type," i.e., with multiple evaporators and modern equipment were working. The average output of each of these plants was 60,000 bags of 60 kilos (per "safra" of seven months), whilst the medium value of a plant may be set down as being £62,500.

The average yield per acre is 26·3 tons of cane, the extreme amounts being 13·5 tons on exhausted soils, 45 tons on virgin soil or mechanically cultivated and fertilized ground. One plantation gives 2 or 3, seldom 5 crops whose yields stand to each other as 100 : 78 : 55 : less than 40.

The average quality of cane delivered to the crushers may be described as follows : age, 12 months ; length, 4 ft. 6 in. ; and weight, 3·25 lbs. Analytical contents : sucrose, 11·85, extremes being 7·83 and 13·07 ; glucose, 0·92 in. ; and water, 74·43 per cent. ; fibre, 11·65 ; not determined, 1·15 per cent.

The price per ton of cane at the head of the crushers was 13s. 6d. When the sugar mill has to buy cane from growers, it is customary to pay the planter 60 per cent. of the official price of "first-class white" as quoted on the Rio market. This amounted during the last three years to £1 per ton and is understood as due when dumped at the feeding end of the crusher, the planter being responsible for the transport to the mill within a certain amount of time to avoid fermentation of the juice. As small planters meet considerable difficulties in providing for railroad cars at the milling season, they have to spend more in fares and fines than the difference between 13s. 6d. and £1.

When the mill plants its own cane the above stated ton price comprises 70 per cent. agricultural expenses, 20 per cent. labour cost for cutting, 10 per cent. transportation cost ; when the cane is bought, 45 per cent. of the ton price goes to agricultural expenses, 10 per cent. to cutting costs and the balance to transportation to the mill. The average yield of one ton of cane is at the present state of technical development of the majority of the Brazilian sugar mills :—

60 kilos of "first class whites"	at 7d. per kilo	£1 15s. 0d.
20 kilos of *mascavinho*	at 4d. per kilo	£0 6s. 8d.
20 litres of brandy	at 3d. per litre	£0 5s. 0d.

Where in all stages of the manufacturing processes the most recent technical improvements have been put to work the results may be 15 to 20 per cent. better, but these high yields are still exceptions, as the sugar mill man of middle Brazil is still too "conservative" to see the advantages of technical developments which first of all involve big investments of capital. The difference between £1 (cost of raw material) and £2. 6s. 8d. (price of products), i.e., £1. 6s. 8d. per ton of cane has to pay all expenses and forward the profit of the plant.

At a basis of an output of 60,000 bags per run of seven months the cost of production of one bag of sugar amounts at present to 6s., summed up in this figure being labour, power, chemicals, bags, and repairs, but excluding depreciation, taxes and the heavy interest charges. The medium depreciation percentage being in Brazilian sugar mills 12 per cent., the production of one bag of sugar in a £62,500 plant is burdened by 2s. 6d.

Each mill pays in taxes the following amounts :—	£	s.	d.
(1) To the Federal Government : Income tax : 3 per cent. per annum, average	600	0	0
(2) To the State Government : Industrial and professional tax of the plant	33	15	0
Ditto of each of the owners	4	0	0
Territorial tax for the mill area, average	10	0	0
Territorial tax for the plantation area, average	36	0	0
(3) To the Municipality :—			
Ticket of permission to run the mill	18	10	0
Ditto for balances, warehouses, stores, for hands, medical equipments	48	10	0

These are merely the direct taxes : in indirect taxes are to be paid :—

(1) To the Federal Government:

Tax on distillate, 2d. per litre, average £500 per annum.

Transportation tax 7d. per bag of sugar, £1750.

Stamps on sales documents, 1s. per £25, at least £250 per annum.

(2) To the State Government :—

Consumption tax on sugar and by-products, at least £600.

(3) To the Municipality —

Contribution of 1d. per bag of sugar, or per annum £250.

So much for the time being ; for the next crops taxes seem further to increase. The total amount of £4100 per annum burdens the bag of sugar by approximately 1s. 4d. Labour, depreciation and taxes sum 9s. 10d. ; out of the above mentioned difference of £1. 6s. 8d. remain therefore only 16s. 10d. of surplus to cover the heavy interest charges—up to 24 per cent. per annum—on loans from the Federal or the State Banks and to show a moderate profit.

These are the results on the more modern bigger sugar mills ; on the smaller establishments the final figures undoubtedly would be still more disappointing. The low average yield and the tardiness with which technical improvements are finding their way into the Brazilian sugar districts must be held responsible for this state of affairs. For European machinery manufacturers a wide field of activity is still open here. It well deserves to be cultivated.

Recent Work in Cane Agriculture.

THE IMPROVEMENT OF PLANTS. **G. L. C. Howard.** Presidential Address to the Agricultural Section of the Sixteenth Indian Science Congress, Madras, January, 1929. Agricultural Journal of India, Vol. XXIV, Part III, May, 1929.

After some introductory remarks of local import, the author of this paper develops certain principles which should guide workers on plant improvement in the tropics, and especially in India. She then passes on to a discussion of the changes which have taken place in our conceptions of the science of heredity, and their influence upon the practical methods employed. It is noted, at the start, that the subject of genetics is at the present moment in an interesting transitional stage, and thus offers a good example of the periodic, pendulum-like oscillations which take place in the development of all branches of science.[1]

But in spite of such changes, the object of the plant breeder is always the same, namely to produce a variety with an increased money value. Such increase may be due to greater yield per acre or to better quality in the produce; and, under the conditions prevailing in India, the former is a much more profitable aim to be held in view. An increased yield per acre is very easy to understand and immediately reaps its reward, whether it be through increased potential yielding power of the new variety, greater resistance to disease, or to a root system better suited to its environment. A variety with better quality is more difficult to obtain, and much more so to establish for a number of reasons, the most important of which is perhaps the fact that it is rare, in the earlier stages, for the grower to reap any advantage. The market, moreover, may change rapidly in its requirements, while the work needed for the production of such a variety is a lengthy business, usually requiring quite a number of years. For success along the quality line, which is almost always held in view by the worker, it is considered advisable to delay distribution until increased yield has been superimposed on the superior quality.

But, besides increased yield and improved quality, a third and very important character is insisted on, namely, that the new variety is capable of growing over a wide area of country, in spite of differing environmental conditions : it must be agriculturally elastic. Trade requires large quantities of a standardized product, and these can only be obtained by growing one kind over large areas. This last improvement is very difficult to effect, but it is by no means impossible, the Indian examples given by the author being the cane S48 and Pusa No. 4 wheat. Closely connected with this point is the much discussed question as to the number and character of the breeding stations needed for the work. Should these be placed wherever a particular set of conditions prevails, to improve the local crops, or should they be fewer and more efficient, and independent of local environmental factors ? The author is emphatic that, from financial, administrative, and commercial considerations, the few large stations are to be preferred.

Along the same line of reasoning another point emerges. The worker, naturally desirous of approval of his work, may be seized with the idea of putting out a new variety as soon as possible ; but the author strongly advises self-denial in this respect. For success, the improvement must be great. A rapid succession of small betterments will not enhance the reputation of the experiment station, it will confuse the cultivator, and in case some do not come up to expectations he will probably prefer to return to his old established and well known forms, rather than undergo the trouble and expense of trying the new strains : his confidence will be shaken. Taking as an analogy the

1 The present summary is confined to the first part of the paper, designed for the guidance of workers.

pictures in an exhibition, which may vary from the numerous productions of local amateurs to the few rare works of real and outstanding merit, the author demands that the public should only be treated to "masterpieces." This is of course an economic question, and the employer must share the responsibility. He should recognize that this is the only sure way to obtain the desired result, and must give the worker to understand that he will, within reason, be prepared to allow ample time and facilities for this policy to be followed. The selection of the worker in the first instance is therefore all-important and that responsibility must be borne by the employer.

Improved varieties may be produced by two methods, selection and hybridization. The author analyses the mental endowments necessary for the successful prosecution of these two methods in plant improvement: "An erroneous impression is current that selection is extremely easy and within the scope of untrained men whereas to obtain an improvement by hybridization a mysterious process needing great scientific knowledge and insight is required. This is not fair to those who use the selection method. It is largely due to a confusion of thought in which the breeding of an improved variety is considered to be of the same order as an investigation into the laws governing inheritance." And even the Royal Commission on Agriculture in India are quoted as having been at least "unfortunate" in their wording: "Hybridization is a much slower process than selection and requires greater scientific experience and a higher level of scientific aptitude . . ." The qualities required in the two lines of work are identical and are thus summarized: (1) a detailed and first-hand knowledge of the botanical constitution of the crop and its physiological requirements, (2) insight and judgment in correctly selecting the most promising plant.

The difference between the methods of selection and hybridization lies in the nature of the material available. In the first, it is provided by nature, and is best conducted where crops of mixed types are grown or where natural cross-fertilization or mutations occur; in the second, the material is prepared by the worker himself by attempting to combine desirable characters found in different individuals, and to practise selection among the resulting forms. Investigation into the laws governing inheritance is an entirely different matter, and the author completely separates it from the work of the plant improver. She goes further, and lays it down that if an attempt is made to combine the two studies, there will be the chance of falling between two stools and succeeding in neither. This fundamental study is the subject of the rest of the paper and is not dealt with here. Summing up, then, the author writes: "Every crop in India requires a few first class varieties combining good quality and high yield, each suitable for a large tract of country. It is immaterial whether these improved types are produced by selection or by hybridization, but it must be realized that whichever method is adopted varieties of this class can only be evolved by men of sound scientific training and great natural aptitude. In addition, they must be given sufficient time to produce something really worth distributing. Whichever method is used, success depends on the man and his training."

FACTORS INFLUENCING THE GROWTH AND SUGAR CONTENTS OF CANE. **K. Krishnamurti Rao.** Paper read at the Indian Science Congress, Calcutta, January, 1928. Agricultural Journal of India. Vol. XXIV, Part II, March 1929.

In this paper, the author deals with temperature and rainfall in cane growing countries, and presents a considerable mass of information which he has

collected from various sources. He emphasizes the fact that sugar cane is essentially a tropical plant, and points out that the more important cane growing countries, where sugar is the product, practically all occur within the tropics, accounting for 90 per cent. of the world's output. India, on the other hand, where gur or jaggery is the product, reverses this geographical arrangement, and 80 per cent. lies in sub-tropical regions, chiefly in the Punjab, the United Provinces, Bihar and Bengal. It might have been more definitely stated in this place that the main fact accounting for this disparity is that the species of sugar cane grown in India is, according to the current view of experts, a different species from that grown in the tropics. Two good maps are printed, which show the relative distribution of sugar cane in the world and in India.

Temperature and water conditions are then discussed in some of the tropical countries, and in greater detail in various parts of India ; these conditions are divided into those favourable to and those inhibiting cane growth. The publications of STUBBS and ALEXANDER are drawn upon for details regarding tropical canes, and of MOLLISON and ROBERTSON BROWN, together with experiences at Coimbatore, for the Indian conditions. The general inferences drawn by the author are as follows :—

"(1) Cane growth starts at a mean temperature of about 68°F. and increases progressively with the gradual rise of temperature, reaching its maximum at somewhere about 88°F. mean temperature.

"(2) Growth is arrested when the mean temperature is about 65°F.

"(3) The bud is injured when the mean temperature is about 52°F. Countries which enjoy a long humid season during the period of growth with an average mean temperature of 78°F. (average of 68° and 88°), and a fairly dry cold season with an average mean temperature of 59°F. (average of 65° and 52°) appear best suited for cane cultivation."

Among the paragraphs leading up to these conclusions the following are perhaps of interest. Notes on the amount of water required for a crop of canes have been collected from a few sources : at Poona, 110 in. (MOLLISON) ; at Coimbatore, 140 in. ; in Louisiana, 60 in. ; and in Hawaii 228 in. (ALEXANDER). The small quantity required in Louisiana is accounted for by the short growing period, as compared with the long one of 460 days in Hawaii, and the humidity of the atmosphere ; but it might have been pointed out that crops considered satisfactory in Louisiana are very different from those demanded in Hawaii ; and that, by the scientific application of the economics of irrigation in the latter, much larger quantities of water are applied than are necessary for healthy cane growth—probably far more than the soil of Louisiana would be able to stand. With regard to the most suitable moisture content of the soil for sugar cane, two estimates are quoted from Hawaii. ECKHART gives 31·38 per cent., while ALEXANDER'S figure is 26 per cent., "because proper aeration of the soil is possible with this degree of soil moisture."

The question as to whether the water requirements of the sugar cane can be wholly met by irrigation is considered in some detail. A number of general opinions of different observers are recorded, tending to show that, although the cane may be fully irrigated, a notable spring in growth is seen after a shower of rain. Hot, steamy air appears to be an important incentive to cane growth, and this cannot be given by irrigation in dry regions. The advantages of rainfall, as contrasted with irrigation, are summarized as follows : increasing the moisture content of the air and moderating excessive heat, washing the leaves and thus promoting transpiration, washing out plant toxins from the soil and the accumulations of harmful salts near the surface,

also dislodging the egg masses of injurious insects, and, lastly, adding small quantities of nitrogen from the air.

In the second part of his paper the author proceeds to "apply his conclusions" to various countries and parts of India; but this application takes more the form of brief summaries of temperature and rainfall conditions. Cuba, Java, Porto Rico, Mauritius and Hawaii are the countries treated, but the details are extremely meagre and hardly comparable. The tables of temperature and rainfall in the "more important cane tracts" in India are much fuller, and 16 localities are analysed. But the selection of these appears to have been influenced rather by geographical considerations than by their importance as producers of sugar, and this appears to be specially so with regard to the rainfall averages. Taking South India where eight localities are given, two of them, Calicut and Cuttack, can hardly be considered as important sugar tracts; and, moreover, the rainfall in these places is far in excess of that in the main sugar areas—Calicut 118·80 in. and Cuttack 58·78 in. in the year, while Poona has only 27·62, Nagpur 49·23, Cocanada 40·95 and Coimbatore 21·69. The author has not given the full details in his tables, but has selected certain periods for the temperature means, namely, January, May, July and November; and for rainfall, the averages are for every two months, in order, throughout the year. It is, in such a vast area, difficult to make any *selection* applicable to the changing seasons of many localities and we think that it would have been wiser to include the whole of the figures month by month through the year, from which conclusions could be more safely drawn by the reader.

From considerations of space, the writer has presented the temperature and rainfall figures as averages for the several tracts into which the author has divided his countries, i.e., geographically; and, as regards rainfall in the peninsula, Calicut, Cuttack, Amraoti, Bijapur have been omitted, and averages struck for Poona, Nagpur, Cocanada and Coimbatore, well known sugar cane centres.

NORMAL MEAN MONTHLY TEMPERATURES.

	Number of Places	January °F.	May °F.	July °F.	November °F.
Peshawar	1	51·3	84·0	90·9	61·7
Punjab	2	54·6	89·0	89·6	65·8
United Provinces	5	60·9	91·3	86·0	70·1
The last two	7	59·1	90·7	87·0	68·9
The Peninsula	8	72·9	89·3	80·7	75·6

RAINFALL OF CANE-GROWING TRACTS IN INDIA.[1]

MEAN MONTHLY AVERAGES IN INCHES.

	Jan.-Feb.	Mar.-Apr.	May-June.	July-Aug.	Sept.-Oct.	Nov.-Dec.	Total
Peshawar	—	—	—	—	—	—	14·00
Punjab	3·36	1·66	3·25	13·98	2·68	0·78	25·77
United Provinces	1·40	0·53	7·01	22·61	8·32	0·45	40·33
The last two	1·96	0·88	5·94	20·14	6·71	0·55	36·17
The Peninsula	0·63	1·23	6·28	12·61	10·75	3·36	34·87

The deduction is drawn from these figures and those of temperature, that the climate of the Peshawar valley is less mild than that of the Punjab. But both are severe on the cane, and as we move to the south-east better conditions prevail, as in the United Provinces and Bihar. But even there and in north India generally, the conditions are not such that thick canes can mature properly, and they are only grown near larger towns for chewing purposes. In the tropical peninsula, on the other hand, matters improve in this respect,

[1] Bengal and Southern Assam are omitted by the author.

with a fairly long growing period and a fairly cold dry season for maturing the canes. The Madras conditions are the best in India for cane growing, but they are less favourable for ripening.

The author then deals briefly with "other conditions influencing the sugar contents of the cane" The first of those is the onset of rains when the cane is ripe, which lowers the sucrose in the juice by inducing shooting of the buds As an example the author selects the analyses of some sixty Coimbatore seedlings raised in 1915 and analysed at two periods in the following year: in May when they were mature, and six weeks later after a downpour of 3 in. of rain The sucrose percentages in the juice are plotted out and the curves printed on a Plate In every case the sucrose percentage was less in the second period, the average difference being somewhere between 18 per cent. in the first period and 15 5 per cent after the rain A similar loss of sucrose in juice after rains is shown in an example quoted of beets grown and analysed in New Zealand in 1918 19

Continuous moist weather without a well defined ripening season has a similar effect on the juice, and to illustrate this certain varieties of cane grown on two experiment stations in the Madras Presidency are compared, namely at Samalkota where the conditions are eminently favourable, and at Taliparamba on the west coast where the rain is even heavier than at Calicut, and, although less rain falls in the ripening season, the mean temperature then is still high The following are the sucrose percentages in the juice in five varieties grown at the two places, that of Samalkota being placed first Red Mauritius 16 8 and 14 4, Striped Mauritius 18 9 and 16 9, Pansahi (a cane like Uba) 15 1 and 12 8, Chin (a thin hardy north Indian cane) 16 2 and 12 4; while in B 208 the difference was less, over 19 0 and 18 1

Saline soil with a good deal of chlorine lowers the sucrose and glucose in the juice, and three Indian canes and three Coimbatore seedlings are chosen as exemplifying this Averaging the whole of the juice figures in the Table as before, we have the following

	Sucrose Per Cent	Glucose Per Cent	Purity Per Cent
Canes grown under saline conditions	10 16	0 24	70 40
Ditto non saline do	12 66	0 80	78 05

The quality of the irrigation water has a somewhat similar effect "Sodium chloride in irrigation water is the most harmful for sugar cane cultivation. Anything over 75 parts in 100,000 of water is not desirable"

Lastly, the harmful effect of over heavy doses of nitrogenous manure, in retarding maturation of the cane, is illustrated by an example drawn from Manjri farm in Bombay Presidency The details of this need not be given, but, although an enormous out turn was obtained with 693 lbs. of nitrogen per acre, the net profit on the sale of jaggery was less than with an application of 225 lbs.

C. A. B.

Some Australian Results [1]—Babinda Central milled last crop 194,259 tons in 24 7 weeks, time lost, 15 hours, extraction, 95 5, average crushing rate, 49 97 tons per hour, range of C C S, 11 87 to 15 52, average 14 23 per cent, yield of cane per acre, 19 38 tons, available sugar per acre in tons C C S, 2 724, burnt cane, 36 1 per cent of the total crop, firewood consumption 0 020 tons per ton of cane, fibre in cane, 10 13, tons cane per ton of 94 n t sugar, 7 15, recovery of sugar entering mill 88 3 per cent, recovery of sugar entering manufacture, 92 7 per cent; final molasses true purity, 47 4° The major portion of the molasses was burnt as fuel.

1 *Aust S. J.*, 1929, 164

Java Technical Notes.

BAGASSE BRIQUETTING. J. Eigenhuis. *Handelingen van het Tiende Congres, Java*, 1-20.

At the Sewoegaloor s.f. the surplus bagasse has been baled since the 1925 season, the intention being originally to sell that which was not required for the estate locomotives. But since then canes other than the red 247 formerly much cultivated have been ground, and the amount of bagasse available has gradually diminished. Wet bagasse as such is unsuitable for baling, as, owing to the great pressure developed in the machines, steam may be evolved, and to such an extent that an explosion accompanied by the generation of gases and charring may result. Drying the material until it "no longer feels moist in the hand" suffices (no figures corresponding to such a water content are given), and this is done simply by spreading out the bagasse in fields to a thickness of 20 cms., about 7-12 hours sufficing. This mass is turned over as with hay. Bagasse stored wet in heaps undergoes a spontaneous fermentation after about 10 days, and a temperature of 100° C. and sometimes higher can be reached in the centre of the heap, the water content of which is much diminished. This change passes through stages which can be distinguished as follows: (1) Slightly fermented, the bagasse being white and loose; (2) fermented, leaving it white and somewhat looser; (3) "old" being then light brown and quite loose; and (4) "perished," the material then being dark brown to black and similar to mould. Freshly dried bagasse as a rule gives no trouble in the briquetting presses, provided that certain precautions are taken. When it has fermented to the third and fourth stages just mentioned above, it gives very fine hard briquettes, which are black to brown in colour. Such fermented bagasse mixed with dried fresh bagasse also gives very good briquettes, as does again fresh bagasse (100 kg.) mixed with molasses (25 kg.) and well dried, the molasses being diluted before it is spread over. Regarding the weight of the briquettes which can be stacked per cub. metre of space, this is 12 piculs, compared with 7·8 piculs for bagasse baled with modern presses, and 4·2 baled with ordinary ones. As to working costs, these are stated to be 0·28 Dutch florin per cub. metre, including the cost of the bagasse and the rent and depreciation of the machines. This, however, is said to be a figure lately obtained when the plant was not working to its full capacity.

VARIOUS FACTORY PROCESSES PRACTISED IN JAVA. H. A. C. van der Jagt. *Verslageecner Reis ter Bestudeering der Suiker-Industrie op Java.*[1]

Following are some notes made from a report of a recent visit by the author to Java to learn the latest practice there.[1] *De Haan's Carbonatation.*—This important modification is now applied in almost all the carbonatation factories in Java, the lime and carbonic gas being added simultaneously after the raw juice has been heated to 55°C. An alkalinity of about 250 mgrms. of CaO per litre must be maintained throughout the operation. Its effect is largely physical, the extremely fine particles of calcium carbonate formed having the property of adsorbing non-sugars much as with decolorizing carbons. In working inferior juices, it should be applied in two stages, so-called double carbonatation. *Harloff's acid thin-juice process.*—Careful control extending over a number of years shows that when the *pH* tests at 6·7 glucose decomposition is reduced to a minimum without any appreciable inversion. Condensed water from the second body is said not to react acid. Massecuites very light in colour and easily cured are obtained. A beautiful white sugar is produced. Sulphiting the juice entering the evaporators according to this

[1] See *I.S.J.*, 1929, 438.

method is certainly a most important operation, one to which too much attention can hardly be given. *Hot raw juice sulphitation.*—This means first heating the raw juice to 70-80°C., and then liming and sulphiting. In cold sulphitation more or less trouble is experienced with heater and evaporator tube scaling, which is diminished greatly with hot sulphitation, when the greater part of the calcium sulphite separates in the sulphiters and the formation of calcium bisulphite is avoided. One can here apply the principle of "simultaneous saturation" advantageously with regard to the avoidance of glucose decomposition, that is sulphiting and liming simultaneously at a high temperature. *Altman's sulphitation.*—Unlimed raw juice is passed through the heaters till it is about 85°C. into the sulphitation tanks; then the SO_2 valve is opened, so that the juice is strongly agitated, all the lime being immediately added. One must have powerful sulphur apparatus, by means of which it can be possible to sulphite off in a few minutes. ALTMAN in this process takes advantage of the fact that the higher the temperature of the juice at which the calcium sulphite precipitate is formed, the better is the purifying quality of this precipitate. *Van der Jagt's sulphitation.*—In this method a solution of calcium saccharate (obtained by dissolving lime in cold raw juice) is used in place of milk-of-lime in the hot sulphitation process, heating the raw juice preliminarily to 85-90°C., and finishing at a *pH* of 6·8. *Mud treatment.*—Resulting from the insufficient clarification afforded by the sulphitation process, the flocculated particles are incompletely surrounded by calcium sulphite, so as to render the mud filtration more or less troublesome. But one can rectify this state of things by simultaneously liming and sulphiting the mud, using a fair quantity of lime, viz., 15-20 litres of 15°Bé. per cub. metre of the mud from the settling tanks, this giving about 5 or 6 kg. of calcium sulphite in the form of fine grainy particles which attach to the slime, giving an easy filtration. After the simultaneous sulphitation, steam should be blown into the liquid to raise its temperature to about 100°C., preparatory to the actual filtration. *Defecation Modification.*—HARLOFF has proposed the heating of the raw juice to 85°C. before the addition of the lime in ordinary defecation on the basis of laboratory experiments, which have shown that the duration of subsiding is shortened, that the juices are clearer, that the volume of mud is less, that the actual dry substance of the precipitate is greater, and that the syrups resulting are less viscous. Applied on the technical scale, at the Kawarassan factory of the H.V.A., the best results were obtained when the raw juice was heated nearly to boiling point previous to boiling. Probably in connexion with this modification of the tempering process the use of calcium saccharate solution prepared in the cold in place of milk-of-lime constitutes an improvement. *Mud-on-Bagasse process.*—Juices from the first, second and third mills on the one hand and that from the fourth mill on the other are limed and subsided separately, using the Harloff liming process just mentioned for so doing, the mud obtained from the purer juice being sent for settling with the less pure, and the mud from the latter going over the bagasse leaving the first mill. LANGGUTH STEUERWALD obtained very satisfactory results at the Pangoongredjo s.f. with this process, but failed to do so at Kenongo s.f. It may be that the varying nature of the juices may account for the difference of opinion that exists in regard to it. *Thick-juice Treatment.*—Views expressed on the Bach process, the use of kieselguhr, and on centrifuging as means of purifying the evaporator syrup in white sugar manufacture are mainly in a line with those of HONIG, which have recently been reviewed in these columns.[1] This writer has apparently most faith in *doek* filtration as econo-

[1] *I.S.J*, 1929, 429.

mical means of obtaining a crystal-clear syrup for the vacuum pans in making good white sugar, though certain precautions are necessary, the principal amongst them being the following : (*a*) The syrup must first be heated to boiling temperature ; (*b*) the filters containing the *doek* should be sterilized before use by steaming well ; (*c*) filtration must proceed slowly, and without disturbance by shaking ; (*d*) attention must be paid to the temperature of the syrup before and after the filtration, and (*e*) the *doek* must be washed after a certain time, say every 30 hours. After the *doek* filtration, the syrup is sulphited, but the formation of a precipitate after this further sulphuring seldom or never occurs. Subsiding syrups for where sugar making is out of date. Compared with some kind or other of filtration, it is said to be like "travelling in a towboat as contrasted with a train." *Massecuite working.*—In this part of the report a description is given of the Lafeuille crystallizer, and an account of some satisfactory results obtained with low massecuites. In different factories the writer saw pan microscopes in use for the control of the boiling process, whilst in others a magnified picture of the crystals was obtained by a kind of camera obscura. *Re-melting after-product sugars.*—In different factories in Java they have gone over to re-melting the molasses sugar and also the *C*-sugar in the clarified juice, only *A* and *B* sugars being thus turned out as whites. Tjebongan s.f. covers its *C*-sugar in the pre-worker centrifugals with a little water until a colour corresponding to 22 D.S. is reached, this sugar being re-melted in the thin-juice with the help of a little steam to give a syrup of 75°Brix and a purity of 93°, which is added to the evaporator syrup in the sulphiters. Much attention has of late been given to the question of fuel consumption, seeing that a fair quantity of clarified juice thus becomes evaporated in single in place of multiple effect. Altogether, however, it appears that little more is burnt, since the amount of covering water can be reduced by 40 per cent., whilst less steam seems to be required for the covering of the *A* and *B* sugars in the after-battery. In fact seven factories of the Klatensche Culturen Mij. applying the re-melting method found no greater fuel consumption was necessary. Seemingly, therefore, the economy obtained by diminishing the quantity of first cleaning syrup is greater than the extra cost of evaporating in single effect. Furthermore, as the result of the re-melting method the sugar losses are not appreciably increased, whilst the white sugar is considerably improved. Lastly, it is mentioned that with decolorizing carbon one may produce a part of the crop in refined by washing the raw sugar, re-melting it to 66° Brix in the wash-waters of the carbon filter-presses, treating with the decolorizing carbon, filtering through Kroog presses, and boiling the very light-coloured filtrate to grain following some suitable boiling scheme.

YIELDS OF JAVA CANE FACTORIES. **H. C. Prinsen Geerligs.** *Die deutsche Zuckerindustrie*, 1929, **54**, No. 26, 725.

Dr. H. CLAASSEN in some recent remarks which he contributed to a German technical paper[1] referred to the following figures expressing the maximum and minimum yields of 178 Java sugar factories :—

	Maximum.	Minimum.	Average.
Defecation	13·70	9·49	11·94
Sulphitation	13·94	9·92	12·17
Carbonatation	14·10	8·09	12·45

[1] D.Z.I., 1929, 54, No. 24, 678.

He had said that differences even approaching these do not occur in beet sugar factories, and he wondered whether those Java factories having yields lying much below the average carried on for long. Dr. PRINSEN GEERLIGS in reply gave his eminent colleague of the sister industry some information regarding the interpretation of cane factory data, pointing out firstly how the composition of the raw material with which one works in the tropics varies, and secondly that if factories have low yields it is mostly to be attributed, at least in Java, to the low content of the cane, and not to the mode of working. During the 1928 crop, for example, in the country under consideration the maximum, minimum, and average figures for sugar, fibre, and juice purity were :—

	Maximum.	Minimum.	Average.
Sucrose in the cane	15·2	9·8	13·5
Fibre in the cane	17·7	10·3	12·7
Purity of the raw juices	88·6	74·3	84·3

Dr. GEERLIGS then went on to explain the significance of the values for the extraction, Winter rendement, and the purity of the molasses, and reproduced the following data for factories which were mentioned by Dr. CLAASSEN, showing that when compared on the three bases mentioned the differences are not great after all.

	Sucrose: Per 100 of Cane.	Sucrose: In Juice per 100 of Cane.	Sucrose: Per cent.	Purity: Juice.	Purity: Molasses.
Semboro	9·80	9·27	**94·7**	74·3	**34·9**
Djatiroto	11·00	10·36	**94·2**	77·9	**33·3**
Baron	11·90	10·98	**92·3**	80·5	**36·1**
Panggoengredjo	15·00	14·60	**97·3**	86·1	**39·3**
Krebet	15·20	14·40	**94·7**	87·1	**35·4**
Tandjong Tirto	15·10	14·34	**95·0**	86·8	**33·8**
Average for Java	13·50	12·70	**94·1**	84·3	**34·4**

Factory.	Crystal: Calculated.	Crystal: Obtained.	Winter Rendement.	Standard Muscovado obtained.	Crystal obtained per 100 Sucrose: Cane.	Crystal obtained per 100 Sucrose: Juice.
Semboro	7·99	7·69	**96·2**	8·09	78·4	82·9
Djatiroto	9·19	9·03	**98·3**	9·49	82·1	87·1
Baron	9·92	9·43	**95·1**	9·92	79·2	85·8
Panggoengredjo	13·64	13·18	**96.6**	13·86	87·9	90·3
Krebet	13·54	13·26	**97·9**	13·94	87·2	92·1
Tandjong Tirto	13·45	13·41	**99·7**	14·10	89·0	93·5
Average for Java	11·84	11·56	**97·6**	12·16	85·6	91·0

Although the quality of the raw material is very different, work in these factories is very regular, no large differences being shown. Replying to Dr. CLAASSEN's enquiry as to whether those factories showing a low yield have a long life, Dr. GEERLIGS replied that those which in 1928 had a yield lower than 10 per cent. in standard Muscovado were : Soekowidi (8·91), Djatiroto I (9·49), Djatiroto II (9·65), Baron (9·92), Semboro (8·09), and Goenoengsari (9·42 per cent.). One of these, Baron, is an old Chinese concern ; Soekowidi was built in 1895 ; Djatiroto first operated in 1909, whilst Semboro and Goenoengsari commenced work in 1928. The soil of the latter estate is not yet sufficiently drained, the sugar content of the cane and the purity of the juice thus being low. Semboro and Goenoengsari, however, are well equipped, up-to-date factories which before very many years are expected to show very good returns, though yields of 12 per cent. are not at first to be anticipated. Incidentally, Soekowidi in spite of its low yield of 8·91 made 140 dz. of Muscovado per hectare in 1928, and produced a good return.

Beet Agricultural Notes.

Farm Economics Report.

Cost of Beet.—The Farm Economics Branch of the University of Cambridge Department of Agriculture have issued their Report No. 12,[1] which is a detailed investigation of the costs and returns of 26 farms in East Anglia. The results generally should be found valuable as material for agriculturists, economists, and politicians. Under the heading of "Sugar Beet" are given figures which we reproduce below, obtained during the season 1927, which, it will be remembered, was exceptionally unfavourable for the production of this crop, the average yield for England having dropped to 6·5 tons per acre, whereas during 1924, 1925, and 1926 it was 8·2, 7·8 and 8·6 tons respectively. The figures here tabulated represented an average yield of 7·71 tons for 2303 acres, the average contents of the root being 16·1 per cent.

	Per acre £ s. d.	Per ton £ s. d.	Per cent.
Preliminary cultivations	2 13 5	0 6 11	12·6
Seed, drilling and after cultivations	3 15 6	0 9 9	17·9
Manures	4 13 8	0 12 2	22·2
Harvesting	4 19 10	0 12 11	23·7
Rent, rates and overheads	2 14 7	0 7 1	12·9
Farm cash cost	18 17 0	2 8 10	89·3
Transport and growers' representative	2 5 2	0 5 10	10·7
Total cash cost	21 2 2	2 14 8	100·0
Residual values of manures and cultivations brought forward	0 17 2	0 2 3	
Gross cost	21 19 4	2 16 11	
Credit for tops	2 13 0	0 12 5	
Credit for cultivation residues	0 13 0		
Credit for manurial residues	1 9 10		
Net cost of beet	17 3 6	2 4 6	

As might be expected, the variation in costs and yields on these 182 fields was great; the costs ranging from £10 to £31 per acre, and the yield from 2½ to 12 washed tons. On the heavier soils the costs averaged some £1. 10s. more than on the lighter, but in spite of this the latter had the higher yield by more than half a ton. A close connexion between yield and profit per acre was evidenced by the results.

Some interesting comparisons of the results of different methods of production were obtained. Thus, subsoiling appeared to be of greater value than farmyard manure; fields drilled at the rate of 15 lb. of seed per acre yielded nearly 1½ tons more than those which received less than 12 lb.; fields drilled before the 1st of May yielded nearly 2 tons more than fields drilled after the 19th of the month; fields drilled at 19 in. or less between the rows yielded over 1 ton more than fields drilled at 22 in. or more; a comparison of ridge versus flat work showed no significant difference between the results of the two methods; the cost of production was approximately £1 per acre less, while the returns were more than £2 greater after a fallow than after a straw crop. It will be appreciated, however, that such comparisons may be greatly influenced by climatic conditions, and that it is unwise to dogmatize on the results of one season.

[1] "Four Years' Farming in East Anglia, 1923-1927," by R. McG. Carslaw, M.A. Report No. 12 Farm Economics Branch, University of Cambridge Department of Agriculture. (W. Heffer & Sons, Ltd., Cambridge). 1929. Price: 3s. net. See *I.S.J.*, 1929, 385.

Beet Agricultural Notes.

Ministry Sugar Beet Demonstrations.

This is the second report of the Ministry of Agriculture on their sugar beet demonstrations for the purpose of bringing before farmers the most important points in cultivation.[1] These were carried out as last year with the aid of a grant from the factories.[2] The scheme in general was the same as in 1929.

Width between Rows.—The general conclusion indicated by last year's demonstrations, that narrower row widths providing a higher plant population per acre show higher yields per acre, is confirmed on broad lines. The 24 in. rows gave as a general rule a lower weight of washed beet per acre and a lower sugar percentage than the others. The width of row factor should be considered in conjunction with the distance between plants. This is borne out by the results of the width of singling demonstrations. In one district the results indicate that where the rows were 21 in. or more apart, lower yields of sugar per acre were obtained from the wider than from the closer singling. Where the rows were drilled at 19½ in. apart a better yield was obtained by setting out at 12½ in. than at 10½ in.

A reduction of plant population below 25,000 per acre or thereabouts appears to be detrimental to the yield of sugar per acre, and a dense population e.g. 30,000 to 32,000 or more per acre, did not invariably lead to a higher yield of sugar per acre than a population of only 25,000 to 30,000 beets per acre. On good land capable of growing 11 tons of beet per acre, it is claimed that there is no advantage in having more than 28,000 to 29,000 plants per acre, or approximately a distance of 10 in. between plants on 21 in. work and a distance of 12 in. on 18 in. work.

Ridge versus Flat.—The results are inconclusive and, with the introduction of varying row widths for the two types of work under comparison, they are difficult of interpretation. With equal row widths there would appear to be no significant difference in yield, provided the plant is about equal.

Varying Nitrogenous Fertilizer.—The general inference drawn from last year's trials, that dressings up to 3 cwt. per acre of nitrogenous fertilizer showed a definite increase in sugar per acre, except in fen and warp soil, is confirmed. Varying quantities of sulphate of ammonia—1, 2 and 3 cwt. per acre—were tested in comparison with a control plot. Results vary in different districts as to the maximum quantity for the optimum yield, but a profitable return is indicated for the use of up to 3 cwt. per acre. The increase in yield of sugar and washed beet per acre is definite, even at centres where dung had been applied.

Time for Nitrogenous Fertilizer.—There seems justification for saying that no advantage is gained by omitting the application of nitrogenous fertilizer until the time of singling. Plots at many centres dressed before seed time, or given one-half before drilling and one-half at singling, yielded more sugar per acre than plots receiving the total quantity as a top dressing later. The saving in time and labour by a single application, in addition to the advantage of avoiding top dressing too late, suggests the application of the nitrogen to the seed bed.

Mineral Manures.—On poor fen land, dressings of phosphates and potash show increases in yield of washed beet and sugar per acre in two districts, and evidence was obtained in a third district that some considerable benefit might accrue from the use of mineral manures on very light, peaty, fen soils.

1 *Journal of the Ministry of Agriculture*, 1929, 36, No. 4, 11-24.
2 *I.S.J.*, 1928, 592.

On black fen land in good "heart" no increase in the yield of sugar per acre was evidenced by the application of dressings of superphosphate and muriate of potash whether separately or together. It is interesting to note that in this district plots receiving muriate of potash (either alone or with superphosphate) did not germinate so readily or so evenly as the others. This was more noticeable when the manures were sown simultaneously with the seed by a combined drill.

Variety Trials.—Kuhn P, Dippe E, Kleinwanzleben E., were introduced into the majority of the trials, and although no one variety was consistently of outstanding merit in relation to yield of sugar per acre, Kleinwanzleben E. gave higher yields of beet, Dippe was characterized by a higher percentage of bolters, and Kuhn P. produced the least amount of top. That the differences in sugar percentages were not more marked is due probably to weather conditions, as the season was a favourable one for sugar formation.

In trials in two districts MARSTER's seed gave the highest weight of sugar per acre. On a thin wold soil this variety gave better results than Kuhn P. MARSTER, in comparison with 11 other varieties at another centre, gave a higher sugar percentage, greater weight of washed beet, and consequently a heavier yield of sugar per acre than the other varieties in the demonstration. On fenland soils apart from the more vigorous germination and higher yield of washed beet per acre shown by Kleinwanzleben E., no significant differences were noted.

Waste Lime.—Trials with carbonatation scums from beet sugar factories were conducted at three centres. The lime plot at one centre showed a slightly higher percentage of sugar, ½ ton per acre more of washed beet, and 1½ tons increase in yield of tops. The rate of application was 2½ tons per acre.

Subsoiling.—In one district this demonstration carried out at three centres did not provide consistent results or sufficient data from which to draw any definite conclusions. In a second district the operation facilitated lifting and enabled the beet to withstand better the drought in the spring.

Cross Drilling.—In one district a successful attempt was made to drill a field in two directions in such a way that it could be horse-hoed in two directions. By this means it was thought that there might not only be a more perfect plant but a reduction in the labour bill.

BRISTOL TRIALS, 1928.

Experiments were conducted in the Bristol province on methods of beet cultivation during 1928,[1] and these were on the same lines as the 1927 trials,[2] being carried out on 33 farms. A short summary of the general results obtained will now be given.

Quantity of Nitrogen.—On all types of soil sulphate of ammonia applied at the rate of 1 cwt. per acre produced a significant increase in the yield of beets and tops, without affecting the sugar content. Applications of sulphate of ammonia in larger quantities produced higher yields of tops, but no increase in bulbs, whilst there was a tendency for the sugar content to be slightly depressed. The "no nitrogen" plot was rather backward in early growth and the tops had a sickly yellow appearance throughout the growing season. On lifting it was found that the roots on this plot were much larger than was expected and they were also harder to pull than those on the manured plots.

---

1 Report by A. W. LING, M.Sc., and C. W. LINDLEY, published by the University of Bristol, Department of Agriculture and Horticulture, Agricultural Advisory Office, 22, Berkeley Square, Bristol.

2 *I.S.J.*, 1927, 321; 1928, 532. Published as Bulletin No. 2, "Sugar Beet Trials, 1927," obtainable from the Agricultural Advisory Office, 22, Berkeley, Square, Bristol.

Beet Agricultural Notes.

Time for Nitrogen.—It was preferable to apply the nitrogenous fertilizer at seeding time. On the plots receiving all the nitrogen at drilling and those receiving half at drilling, the beets grew the quickest before singling and had a slightly better germination than those which did not receive nitrogen until after singling. All the differences between the plots decreased as the season advanced and at lifting time all the plots appeared about the same.

Form of Nitrogen.—There was very little to choose between sulphate of ammonia, calcium cyanamide, nitrate of soda, nitrate of lime and nitro-chalk. Slightly better results have been obtained with nitrate of lime on the lighter types of soil and nitro-chalk on the heavier soils, but the choice of the nitrogenous fertilizer depends largely on the unit price of nitrogen in any one of the fertilizers.

Width of Drilling Trial.—A higher yield of washed beets is obtained from the 18 in. rows as compared with rows 22 and 24 in. apart. The sugar percentage was practically the same on all plots.

Average Yields.—The following table shows the average yield of washed beets, tops and sugar content of the beets from all the experimental plots in the Bristol province during the past three seasons.

Year	Washed Beet Tons per acre.	Tops Tons per acre	Sugar Content per cent.
1926	14·5	—	19·6
1927	10·5	11·7	17·1
1928	12·4	9·8	17·6

Beet Factory Technical Notes.

Chemical Control Methods.—Most of the Continental beet sugar producing countries have instituted a uniform system of chemical control, following carefully standardized methods. The latest edition of those adopted in Czecho-Slovakia, entitled "Instructions for carrying out Chemical Examinations in Sugar Factories according to Unified Methods," has recently been published.[1] It has been compiled by a Committee of eminent specialists, including Prof. K. ANDRLIK, Editor O. FALLADA, Prof. A. LINSBAUER, Engineer V. SAZAVSKY, and Dr. O. WOHRYZEK. A study of these well-tried methods, and a comparison of them with those used in other countries, in America and Germany, for example, will be well repaid. Here space can be found only for some of the more special particulars. Detailed directions are given for the sampling of the various products from roots to sugars, the importance of care in this direction being made clear. In determining sugar in the beets, these are prepared by means of the Stanek rasp, or in the absence of this by a coarse hand-rasp having openings of about 5 mm.; then the sugar in this pulp is determined by the hot digestion method, according to which 52 grms of pulp plus 356·4 c.c. of lead acetate solution are shaken in closed metal beakers and placed in a water-bath at 80-85 °C. for half-an-hour, cooled, filtered, and polarized. An alternative method is that of HERLES, using glass flasks, stated to give equally correct results for this product. In sampling fresh slices, it is not permissible to use the fingers, as in this way the longer and richer shreds are taken up. A sampler should be used. The portion removed is sub-divided by one of the following meat-mincing machines: "Keystone" (10 holes), "Rekord," "Max," or "Ideal" No. 22. It is most

1 "Anleitung zur Ausführung chemischer Untersuchungen in Zuckerfabriken nach einheitlichen Methoden"; published by the Sugar Experiment Station, Prague. See also *I.S.J.*, 1929, 36-37.

important that the machine used should be cleaned out well after use, so as to ensure that no particles of dried pulp are left behind in it. Then the hot aqueous digestion method of determining the sugar content is applied, the figure obtained being the basis of the yield for the factory control. Sampling diffusion juice from the sight-glass of the measuring tanks, or from the air-outlet cocks of the diffusers, is not permissible; nor is its de-aeration by employing a vacuum-acting cylinder. Determination of the dry substance in the same product by means of the refractometer is another proceeding not to be recommended.

Regarding exhausted slices, those are examined on the same lines as the fresh slices, and special attention is directed to the recommendation that the examination of the juices expressed from exhausted slices leads to incorrect results, a recommendation which should hardly be necessary now. Sugar in carbonatation scums is done by the zinc nitrate process; in titrating the alkalinity of carbonatated juices the Kappus alkalimeter is used; dry substance is found in all juices by means of the pycnometer; and the lime content of juices is given by precipitating as oxalate and titrating with permanganate. Colour is estimated by the Sazavsky apparatus; and sugar in the after-syrups and molasses is found by a special modification of the double polarization method, calculating the result by the Herles formula in which the factor is $143{\cdot}5 - \frac{t}{2}$. A method for determining the "destructable polarization" of diffusion and press juices. Invert sugar is determined by the classical gravimetric method using a Gooch crucible and reducing the cuprous oxide by alcohol; or in routine work one can apply Pick's process, the amount of cuprous hydrate separated being titrated according to SCHOORL. No standardized procedure has yet been included in these "Instructions" for the carrying out of the determination of the H.I.C. or *pH* value. Directions are given for the calibration of glassware and instruments, as is necessary, in order to be assured of their strict accuracy. An inventory of apparatus, appliances, etc., is also given; and a list of reagents complete this very useful and practical publication for the beet factory chemist of Czecho-Slovakia.

De Vecchis Process.—Three papers have just appeared dealing with the beet dehydration process, the first of which is by Dr. W. GRAZIANSKY, and is entitled "Description of the Scott Dryers at Sanguinetto, Italy[1]." It gives details of the new drying plant installed at the factory mentioned, this having a capacity of 100 tons of fresh roots per 24 hours, and requiring 80 h.p. for its operation. It is on the same lines as the dryer previously described.[2] Coagulation of the albuminoids according to the De Vecchis specification, so that these are rendered insoluble, and do not pass into the juice, takes place in the lower part of the dryer, where a temperature of 90-100°C. prevails, and the time during which the slices are there must not be less than one hour. In the 1928-29 campaign, operations are said to have proceeded very satisfactorily, and the following data are taken from the laboratory and factory log books: (1) Sugar obtained, 10·82 per cent. of the weight of the raw roots introduced. (2) Total loss, 5·39 per cent. on the same basis. (3) Capacity of the factory, 72·6 metric zentners in 24 hours. (4) Fuel consumption in the manufacture of sugar, 7·12 per cent. of the raw roots worked. (5) Fuel consumption for the drying, 9 per cent., same basis. (6) Total fuel consumption, 16·12 per cent., same basis. (7) Consumption of electrical power, 35 kg. watts, per hour per ton of raw roots. (8) Consumption of lime, 0·3 per cent.,

1 *Deut. Zuckerind.*, 1929, 703-704. 2 *I.S.J.*, 1927, 657.

same basis. (9) Consumption of superphosphate, 0·6 per cent., same basis. (10) Labour; previous to the dryers, 18 men; at the dryers, 35; in the factory, 63; technical personnel, 8; a total of 124 men per 24 hours. Or per 1000 ztr. of raw roots: in drying, 40 men; in the further working to sugar, 94 men.

The second paper is by Drs. VL. STANEK and K. SANDERA, of the Sugar Experiment Station, Prague,[1] who have carried out some small-scale diffusion experiments with dried beet slices received from the Eynsham factory. These on arrival gave the following figures: Dry substance, 93·1 per cent.; sugar by digestion, 66·0 per cent.; invert sugar, 1·01 per cent.; invert sugar quotient 1·53; total nitrogen, 0·717 per cent.; carbonate ash, 3·14 per cent.; specific gravity, 1·45; average weight of 1 litre, 0·397 grms.; average length of the slices, 22 mm.; average weight of the same, 0·1188 grms. It was the special purpose of this investigation to ascertain how these dried slices behave during diffusion in comparison with ordinary fresh slices, especially in regard to the albuminoids, whether these are in fact rendered insoluble, and thus prevented from passing over into the diffusion juices. With this object in view, a series of tests was made in a model diffusion battery at the Station, which apparatus, though having a capacity only of 1 litre per cell, was capable of giving a normal diffusion juice. A draw-off of about 125 per cent. by weight was operated, and a juice having a density over 52°Bg. was obtained. A very complete analysis of the dried slices, of the diffusion juice, and of the exhausted slices, enabled one to draw up a balance sheet, of the raw material on the one hand, and of the juice and exhausted slices on the other. Thus it was established that over 95 per cent. of the albuminoids remained behind in the sweetened-off slices, the other forms of nitrogen being distributed very much as in diffusion with ordinary slices. Excepting that the diffusion juice reacted distinctly acid, and contained about 2·2 per cent. of invert sugar per 100 parts of sucrose, its composition compared with ordinary diffusion juice showed no striking difference. It is interesting to note that in drying the amides were not decomposed. On the whole, the diffusion with dried slices presented in normal work no special technical difficulties. Washing out, however, is rather more difficult than with fresh slices. The third paper is by JANKO PROCHÁZKA, Manager of the Oroska s.f., in Czecho-Slovakia,[2] and it can be briefly summarized as follows: The production of sugar from dried slices cannot be carried out more cheaply than the ordinary process of manufacture, nor are juices of higher purity obtained. Dehydration may be applicable in countries where the beets deteriorate rapidly in the ground after a certain period of growth, but it is not of interest generally. It involves a heavy outlay in drying plant, and the cost of this probably counterbalances the advantages which the process may have otherwise. This, many will agree, very reasonably sums up the position in regard to drying processes.

Coloration in Evaporation.—Of late some rather extraordinary results have been reported in regard to the colour which may develop during evaporation in the beet factory, increases from 50 to 90 per cent., and sometimes even more, having been found. Such results certainly appear exceptional, and probably have to do with evaporators that are not well designed, having too great a heating surface, and in consequence a sluggish circulation. In order, however, to obtain some idea of what the increase may be under normal conditions, Mr. E. SAILLARD collected a series of samples from the evaporator

1 *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, 53, No. 41, 525-534.
2 *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, 53, No. 33, 453-456.

of the Guignicourt (Aisne), France,[1] taking the following : Entering the apparatus, from each of the bodies, and leaving the apparatus, these samples being sent to the Syndicate Laboratory in Paris, and there carefully examined with the results seen in the table here reproduced. It may here be pointed out that the factory (slicing 500 tons daily) operated in the conventional manner throughout, that is to say diffusion and carbonatation carried out in the usual way, and the clarified juices not being sulphited. As for the evaporator, this was a standard quintuple, the first body of which was heated with exhaust steam at 1·4 or 1·5 kg. pressure, and also with direct adjusted to the same pressure, the average temperatures of the juices in the five effects being 119, 110, 100, 83 and 60°C.

	Entering	First body	Second body	Third body	Fourth body	Fifth body	Leaving
Dry substance, per cent.	14·56	22·00	27·75	30·87	38·20	50·86	51·84
Refractometer d.s...	14·60	22·02	27·80	30·90	38·40	51·00	52·00
Polarization	13·30	20·10	25·40	28·20	34·90	46·55	47·50
Ash	00·44	00·66	00·83	00·94	01·14	01·50	01·52
Purity, true value	91·20	91·40	91·50	91·56	91·30	91·60	91·62
Saline coefficient	31·20	31·40	30·60	30·30	30·60	31·03	31·10
Reducing sugars	—	—	—	—	—	0·075	0·08
pH	8·40	8·30	—	—	8·20	8·10	8·00
Alkalinity (CaO per cent. of sugar)	0·14	0·018	—	0·014	0·013	0·012	0·012
Lime salts, same basis	0·33	0·29	0·24	0·24	0·21	0·20	0·19
Coloration	100·00	104·00	—	—	105·00	107·00	108·00

As the result of the figures obtained, it was concluded that : The increase of colour did not exceed 10 per cent., being actually 8 per cent., thus proving that under ordinary conditions with juices that have not been sulphured it is really small ; the destruction of sugar by heat had been insignificant, if in fact any ; there were reducing sugars only in the syrup taken from the fifth body, and in that leaving that compartment ; loss of alkalinity took place almost entirely in the first body, as indeed was the case with the small increase of colour, changes in the later bodies having been slight : neither the purity nor the saline coefficient underwent any appreciable alteration during the course of evaporation ; and lastly the difference between the direct polarization and the sucrose by double polarization (Clerget) was insignificant, showing that there had been no formation of dextro-rotatory matters.

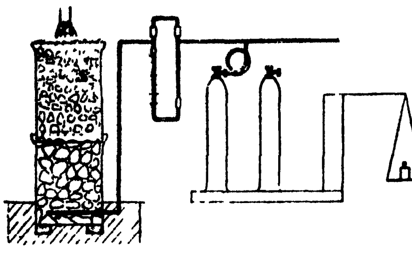
Evaporation, using Carbon.—In some experiments previously reported,[2] it was discovered that if evaporation takes place in the presence of traces of activated carbon, *e.g.*, 0·02 per cent. of "Norit," the calcium carbonate which separates out does so rather on the fine suspension than on the heating surfaces, incrustation thus being diminished. It has also previously been shown[3] that the coloration which ordinarily occurs during evaporation is greatly increased if the juices have not been well clarified, if, for example, sufficient lime has not been used. It has further been demonstrated[4] that the addition of carbon previous to evaporation has a great effect in diminishing the development of colour during evaporation. In order now to obtain further information on these observations, VL. STANEK and P PAVLAS,[5] of the Sugar Experiment Station, Prague, have examined the effect of various

1 Circ. hebd. Suppl., 2090 of 1929.
2 VL. STANEK and P. PAVLAS : *Zeitsch. Zuckerind. Czecho-Slov.*, 1927-28, 52, 545.
3 VL. STANEK and J. VONDRAK : *Ibid.*, 1926-27, 51, 9, 17.
4 *Ibid.*, 1926-27, 51, 483.
5 *Ibid.*, 1929, 53, No. 38, 493-499.

additions to the juice about to be evaporated, these being allowed to remain during the concentration. Their experiments, carried out in a laboratory apparatus allowing of the evaporation of about 400 grms. of juice of 15°Brix to about 100 grms. of 60°Brix in the course of about one hour, lead to the following conclusions : The presence of a small quantity of decolorizing carbon (about 0·02 per cent. of the weight of the juice) during concentration acts very favourably on the final colour, inhibiting the formation of coloured bodies to a marked extent. Carbons act very differently in this respect ; for example, the various commercial grades of " Norit " show figures for decolorization varying from 67 to 100 per cent., compared with the untreated juice. " Standard Norit " gives the best results of the different types of " Norit," but " Carboraffin " gives even a better result than does " Standard Norit." It is further apparent that the favourable result on the colour of the evaporated juice does not depend entirely on the decolorizing power of the carbon concerned. Wood charcoal and aragonite exert much less effect ; still they do prevent coloration, and indeed show some decolorization, their figures being 22 and 16, as compared with 77 and 86 for " Standard Norit " and " Carboraffin." Kieselguhr behaves in a somewhat similar manner to above two inert materials. But the best results of all are obtained with a mixture of " Standard Norit " (0·02) and sodium sulphite (0·01 per cent.), a juice thus resulting which was lighter to a marked extent than before concentration. This appears a line of study well worth pursuing, though it is pointed out that the results obtained greatly depend on the nature of the juice with which one has to deal.

Effluent Treatment.—Previous to 1928 the method of treating the waste-waters of the Vyskov beet factory, Czecho-Slovakia, was to subside in a series of setting basins after the addition of lime and sodium humate, but the desired results had not been obtained. According to the writer of this article, JOSEF JASKOLSKI,[1] satisfactory results in respect of deodorization and sterilization have been obtained by the use of chlorine. First the effluent comprising the flume and washing waters of the factory was treated with lime in a preliminary settling basin at the rate of 160 kg. per 1000 quintals of roots, which amount of lime was a marked reduction compared with that formerly found necessary. No humin was used. Then the subsided water was treated with chlorine at the rate of about 5 kg. per 1000 quintals (or 5·5 mgrms. per litre) using an absorption tower, after which it went through a final settling basin, three other basins which formerly had been in use without chlorine having been cut out. Lastly the water, when it had been given a slight chlorine reaction, was returned to the factory for re-use, the number of micro-organisms per c.c. having been reduced from 341, 200 to only about 400. It is estimated that the amount of the mixed waste-waters of this factory was equivalent to 1 cub. metre per quintal of roots worked. In the old method of working, using 300 kg. of lime, 20 kg. of humin earth, and 2 kg. of caustic soda, the cost worked out at 6·7 hellers per 100 kg. of roots for these materials alone, the interest and depreciation of the clarifying basins and other plant not being considered. With chlorination, on the other hand, using only 150 kg. of lime and 5 kg. of chlorine, the figure was 5·4 hellers on the same basis, while an odourless and practically sterile water was returned to process in the factory for use again and again. In fact no additional water was introduced, excepting only a little for making up what had been lost in the basins during settling.

1 *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, 53, 501-510, 519-524. See also *I.S.J.*, 1929, 155.



In the illustration is shown the device used for introducing the chlorine into the water so as to obtain a proper admixture. It consists of an absorption tower placed in the canal conveying the waste-waters from the factory, the tower being formed simply of two sewage drainage pipes one on top of the other, filled with coke, coarse in the lower and finer in the upper one. A stream of water falling down through the coke meets the upward flow of gas and entirely absorbs it. There is a strainer placed over the coke in the upper part of the tower, and the gas is introduced through a perforated lead pipe at the bottom. Five cylinders of liquified chlorine are arranged on a scale in parallel and escape of gas occurring over a length of time thus gauged. A number of cylinders are necessary owing to the freezing of the chlorine taking place after one of the cylinders has been running for a short time. It is convenient to use a differential pressure indicator before the tower to indicate the rate of flow of the gas.

Old Beet Drying Processes.—In an article entitled "Revival of old Processes of Production," E. PSENICKA,[1] Manager of the Beroun s.f., in Bohemia, remarks in regard to the OWEN and DE VECCHIS processes that no other process of production can pride itself on such an old age as that concerned with the drying of beet slices with the coagulation of the albuminoids. HERZFELD has stated that even ACHARD dried roots for the preparation of sugar juice. In the year 1837 experiments were carried out at the suggestion of SCHUZENBACH on the drying of beet slices, but these failed owing to the irregularity of the slices, which could not be dried uniformly. J. DZIEGIELOWSKI, in his German Patent, No. 70,996 of January 3rd, 1893, has the following wording: "In order to precipitate the proteins in the slices, the latter before reaching the diffusers are exposed to the action of dry hot air or similar hot gas whilst they are heated to 80-90°C. The proteins remaining in the exhausted slices enhance its food value, and the diffusion juices obtained have only a small amount of organic and inorganic non-sugars." The Belgian engineer, LAFEUILLE (known by his revolving crystallizer) thirty years ago constructed an apparatus, the "Betteravier," for the rapid drying of beet slices, in which by means of a current of hot air he freed the slices of their water content for the purpose of their sterilization. He intended this invention to be used in agriculture, the dried material being sent to the so-called mixed factories. These were believed to be in the position to produce juices of 25°Bé. (45·7°Brix), from which by the use of small amounts of lime and superphosphate syrups capable of being converted to massecuite in vacuum apparatus could be obtained. A similar apparatus was the drum dryer of the SAUERBREY system. All rotating dryers, however, have the same defect, namely that the slices are mashed together, so that most of the resulting pulp causes difficulty in diffusion. W. GREINER states that beet slices can be dried in a multiple effect evaporating apparatus, the process of drying then presenting an analogy to the concentration of juices.

1 *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 53, No. 47, 629-632.

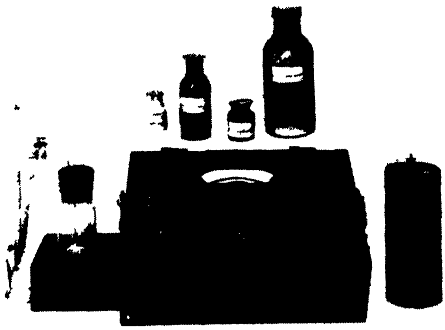
The "Ionometer."

A New Electric *pH* Apparatus.

Determinations of the *pH* value are nowadays an essential feature of sugar-house control; in fact no industry has benefited more from the recognition of its effect on the various stages of manufacture. Colloid flocculation, lime salt precipitation, colour formation and sucrose inversion are all largely dependent on the *pH* value of the juice, syrup or other product concerned.

Hitherto, the *pH* has generally been determined by the well-known indicator method, which is admittedly only approximate, though quite satisfactory in many control operations. It is subject, however, to certain disadvantages, especially the difficulty of matching dark products unless greatly diluted; the limitation of the alkaline range to below *pH* 10·0; and a general accuracy of only about 0·2 *pH*.

Heretofore the electrometric method has also been subject to some disadvantages. The hydrogen electrode requires skilled operation and constant attention; the E.M.F. in alkaline solution is not always attained; and the electrode may easily be "poisoned" e.g., by sulphites. These reasons have prevented this method from being widely adopted in practical sugar-house work



The "Ionometer" Outfit.

Other potentiometric methods overcoming these difficulties have, however, now been developed, such as those involving the use of the quinhydrone electrode and the recently introduced antimony electrode. Both of these electrodes are included in the "Ionometer." The accurate range of the quinhydrone electrode lies between 0 and 8·5 *pH*, and the E.M.F. can readily be duplicated to within 1 mv., i.e., approximately 0·02 *pH*. This electrode, however, does not function accurately in solutions more alkaline than 8·5 to 9·0 *pH*; while also, like the hydrogen electrode, it is affected by appreciable concentrations of sulphites and free sulphurous acid. But it is admirably suited for ordinary cane factories employing simple defecation processes to produce raw sugar. It is also most useful in the refinery. On the other hand, the antimony electrode, which is almost new to the sugar industry, is unaffected by the ordinary "poisons," and further gives trustworthy results up to 13·0 *pH* and slightly over. It should, therefore, find useful application in the beet industry for first and second carbonatated juices, and also for sulphured thin and thick juices. The same will apply to cane factories using the carbonatation process. While it is not as accurate as the quinhydrone method, it affords results well within 0·1 *pH*. By using, therefore, either the quinhydrone or the antimony electrodes, as the case demands, accurate results can be obtained with every kind of product encountered within the sugar industry.

The "Ionometer" outfit consists of a potentiometer, one dry cell, one calomel half-cell, one gold-leaf electrode, one antimony electrode, a sensitive thermometer, a test-glass, and a supply of the necessary chemicals, viz., potassium chloride, quinhydrone, mercury and calomel.

It also includes very full and precise directions for use, by means of which the operator without knowledge of such apparatus can forthwith carry out a determination of the *pH*. The "Ionometer"[1] (as in the case of its predecessor, the "Salometer" or conductivity apparatus for the rapid and accurate determination of ash) should find wide and useful application in the sugar industry.

---

1 Sole Manufacturers: The Sugar Manufacturers' Supply Co., Ltd., 2, St. Dunstan's Hill, London, E.C.3.

Publications Received.

Geschichte des Zuckers. Prof. Dr. Edmund O. von Lippmann. Second Edition (Verlag von Julius Springer, Berlin). 1929. Price: RM .68·6.

It is not so very long since Prof. VON LIPPMANN published his *Geschichte der Naturwissenschaft* and his *Geschichte der Rübe* and before that his *Entstehung and Ausbreitung der Alchemie.* Now he has given us a second edition of his not less impressive *Geschichte des Zuckers.* And all this scholarly work has come from a man who until recently has occupied an important position as a practician, that of manager of the Halle sugar refinery in Germany! Compared with the earlier edition, published in 1890, this "History of Sugar" is considerably enlarged. It has been written on the same lines, but the text has now been much amplified. It must now contain mention of everything of worth on sugar that has appeared in the world's literature from the earliest days to the beginning of beet sugar manufacture in Europe.

Its 17 sections deal with: (1) Prehistory of Sugar (honey); (2) Habitat of the Sugar Cane and of Sugar Preparation; (3) Sugar Cane and Sugar in European Antiquity and the Early Middle Ages; (4) the Extension of Sugar Cane Westwards, and the Discovery of Refining; (5) Sugar under the Caliphs; (6) Sugar Cane and Sugar in the Western Provinces of the Caliphs; (7) Extension of the Sugar Cane to China and the Shores of the Indian Ocean; (8) Sugar in the Times of the Crusaders; (9) Sugar Consumption of Europe in the 14th and 15th Centuries; (10) Sugar in the Renaissance; (11) Sugar Manufacture in America in the 17th and 18th Centuries; (12) Sugar Consumption of Europe in the 17th and 18th Centuries; (13) European Sugar Refining in the 17th, 18th and in the Beginning of the 19th Centuries; (14) Sugar in the Orient since the Beginning of the 14th Century; (15) Substitutes for Cane Sugar; (16) History of Sugar Prices; and (17) Views on the Origin and Nature of Sugar. This is indeed a remarkable work. It is clear that its writing must have demanded wonderful industry, and complete and various scholarship. It is a book which long will be prized by every student of the early beginnings of our industry.

Sugar Beet in the Eastern Counties, 1928. C. Burgess, B.A. Report No. 13, Farm Economics Branch, Department of Agriculture, University of Cambridge. (W. Heffer & Sons, Ltd., Cambridge). 1929. Price: 2s. 6d.

This Report gives the results of an investigation into the financial returns obtained on 100 farms cultivating beet. It describes the method of obtaining statistics, costing methods, the yield, tare and sugar content, and contains a great amount of data of the first importance to farmers interested in this crop, and hardly less to the manufacturer. Washed yield was 9·04 over 167 fields, an advance of 1·3 tons on the average of the 172 fields cultivated for 1927; the average tare for the two years was 14·5 and 20 lbs.; and the sugar content, 17·9 and 16·1, all figures showing a satisfactory improvement. The net cost per acre for 1928 and 1927 was worked out as £17. 4s. 11½d. and £17. 2s. 8¾d., that is, the total cash cost of producing the crop, plus the residual values of the manures, and less credit for tops, etc. Per ton these figures are £1. 18s. 2½d. and £2. 4s. 5½d., a difference of 6s. 3½d. Owing to the increased yield and sugar content of 1928 compared with the previous year there has resulted an increase in the profit to the grower. Per acre the profit for the two years is given as £6. 19s. 9½d. and £4. 4s. 1d.; and per ton 15s. 5½d. and 10s. 10¾d. net, figures which are more satisfactory, though not excessive. Of course 1927 was an unfortunate year, and now the outlook is generally more favourable. Encouraging symptoms are the considerable reduction in costs, the result of more experience, and the more extensive appreciation and use of tops and pulp. "It cannot be pretended, however, that the future is by any means assured, and if this young industry is to survive the depression in the sugar trade, considerable advances have yet to be made."

Die Maschinentechnik in Zuckerfabriken und Raffinerien. Karl Schiebl. Part II. (Schallehn & Wollbrück, Magdeburg). 1929. Price: RM. 13.5 (stiff covers).

This is the second part of a book dealing with the plant used in beet sugar factories and refineries, the first having been published in 1927.[1] It now treats of

[1] *I.S.J.*, 1927, 496.

boilers and furnaces, of the utilization of heat in waste gases, of draught, of boiler-house control, and of the economical distribution of steam. It summarizes a considerable amount of data relating to modern German practice.

Eenige Beschouwingen over de Financiering van de Suikerindustrie en den Suikerhandel op Java. [Some Considerations on the Financing of the Sugar Industry and the Sugar Trade of Java.] E. G. J. Gimbrère. (Drukkerij Henri Bergmans & Cie., Tilburg, Holland.) 1928. Price : Fl. 5 (paper covers).

This small book (in Dutch) reports six lectures by the author made by him at the commercial high school of Tilburg, and gives an account of the history of the sugar business in Java, of the foundation of the V.I.S.P., and of the operations of this same organization and also of the N.H.M.

An Introduction to the Chemistry of Plant Products. Paul Haas and T. G. Hill. Volume II : Metabolic Processes. Fourth Edition. (Longmans Green & Co., London). 1929. Price : 10s. 6d. net.

This is the second volume of the fourth edition of HAAS and HILL's useful "Introduction," the first having appeared a few month's ago.[1] A section of interest is that on the synthesis of carbohydrates by the plant, which is outlined very well. WILLSTÄTTER and STOLL support BAYER's hypothesis that carbon dioxide is split by the plant into carbon monoxide and oxygen, and that the water also is resolved into its constituent elements, the carbon monoxide and hydrogen combining to produce formaldehyde, which polymerizes to form a hexose sugar. On the other hand, ERLENMEYER has suggested that formic acid is the more likely intermediate product, whilst MAQUENNE has formulated a theory of photosynthesis which is independent of either of these two intermediate products. Other sections deal with respiratory processes and with growth. These theories are clearly presented.

Handbuch der Spiritusfabrikation. Dr. Georg Foth. (Verlagsbuchhandlung Paul Parey, Berlin). 1929. Price : Rm. 76.

List of contents includes : General review of processes of spirit production ; most important constituents of raw materials ; enzymes concerned in the physiological processes ; most important micro-organisms ; laws of fermentation ; products of alcohol fermentation ; yields to be obtained ; water used in the distillery ; preparation of malt ; preparation of the yeast ; beet distilleries ; molasses distilleries ; special processes for the production of glycerin, acetone and higher alcohols ; production of ethyl alcohol by chemical processes ; rectification of raw spirit ; utilization of alcohol for technical purposes ; utilization of by-products and residues ; chemical examinations of different kinds. This book contains 1166 pages ; and there are 378 illustrations in the text, and eight tables.

A Report on the Development and Costs of the Oxford Process for the Production of Sugar from Sugar Beet. Issued by the Institute for Research in Agricultural Engineering, University of Oxford ; Bulletin No. 4. With a Preface by Dr. B. J. Owen. (Clarendon Press, Oxford). 1929. Price : 2s. 6d.

This report is a continuation of information published in connexion with the Oxford dehydration process, and it summarizes actual working data and costs obtained at Eynsham during 1928-29. These will be found elsewhere in this issue. It is stated that reliable data collected from different sources show that under similar conditions where is a saving produced of at least 30 per cent. in the manufacturing costs by employing the dehydrating process. A recent development in the process is said to be that by which it is possible to produce a marketable sugar by merely diffusion, boiling, and machining, "thus eliminating most of the operations normally entailed in purification."

---

[1] *I.S.J.*, 1929, 160.

Brevities.

Mr. C. Lyle's Fortune.—Mr. Charles Lyle, of Ennismore Gardens, S.W., formerly of Greenock, sugar refiner, lately a director of Messrs. Tate & Lyle, Ltd., left unsettled estate worth £369,315.

Bagasse for Rayon.—It is reported that the Cornstalk Products Co., of Danville, Ill., are in the market for 25,000 tons of Louisiana bagasse for use in making rayon or artificial silk, it having been found that a ve y fine grade of the product can be made from it.

Hawaii's Molasses.—The United Molasses Company, it is stated in London, has entered into an agreement to purchase the entire output of Hawaiian molasses for the next five years. It will be shipped direct from Hawaii to San Francisco, where a subsidiary undertaking has been formed to handle the output.

Canes in Java.—In Java the total area under cultivation for the 1929 crop is 197,085 hectares, or 2172 hectares more than last year.[1] Average figures for the cane varieties planted are as follows : POJ 2878, 93 per cent. ; EH 28, 2·50 ; other POJ's than 2878, 2·00 ; DI 52, 1·75 ; EK 2, 0·25 ; EK Madoe, 0·25 ; and miscellaneous, 0·25 per cent.

Sugar Beet Pulp.—During 1928-29 the total production of dry pulp in the U.K. was 97,451 tons, 86,849 tons being sold for use in the U.K., and 10,458 tons exported.[2] During the same period the total wet pulp produced was 8208 tons and that consumed in this country, 8187 tons. Molassed pulp was produced to the extent of 44,450 tons. Thus 11 per cent. of the dry pulp was exported, whereas in 1927-28 and 1926-1927 the figures were 25 and 59 per cent.

Hyflo-Supercel.—In "Java Technical Notes" in our August issue[3] some experiments carried out at the Somobito s.f. on the filtration of evaporator syrup, affination syrup, and re-melted fourth sugar were described. It should have been stated that the consumption of "Hyflo-Supercel" was 0·19 per cent. (on the Brix solids). This is a very low figure, and points to the remarkable efficiency of this material as a filter-aid.

Cane Cutting Machine.—Promising results are reported to have been obtained with the Miller-Owen cane cutting machine in Queensland.[4] A demonstration is reported to have shown that burnt cane can be cut by a self-contained unit operated by one man, and better than can be cut by hand, the rate being 5 tons per hour. The machine is in the hands of the Mackay Cane Harvester Co., Mackay, Queensland. While it is not claimed that the machine is yet perfect, it is predicted that it will not be long before the Miller-Owen Cutter will be in general use in the cane fields of this sugar-producing state.

New Guinea Expedition.—In an article entitled "Into Primeval Papua by Seaplane," Dr. E. W. Brandes in the *National Geographic Magazine* for September, 1929, publishes an absorbing account of the New Guinea Expedition, illustrated by a good number of photographs of considerable interest. "Neolithic man," he says, "has not vanished entirely. He lives now as primitively as he did uncounted thousands of years ago." His account of the various types of peoples encountered by the "great hawk," and the extraordinary customs of most of them, makes a most entertaining adventure story. In this account, however, very little is said regarding the various canes found.

The B.E.P.O. Chairman.—After ten years of office as Chairman of the British Empire Producers Association, Sir Benjamin Morgan has resigned the post owing to the increasing pressure of his public and private work, and Lord Melchett (formerly Sir Alfred Mond) has been elected to succeed him as Chairman of the organization. This last appointment is a fortunate one for the B.E.P.O., since Lord Melchett's exceptional abilities as a captain of industry, a mediator between capital and labour, and a strong sympathizer with Imperial ideals should make him peculiarly fitted to keep this overseas producers' organization in close touch with the requirements of the consumer at home.

---

[1] *Archief, Mededeelingen* No. 9. [2] *Agricultural Market Report*, 9th August, 1929. [3] *I.S.J.*, 1929, 429-430. [4] *Aust. S. J.*, 1929, 193.

Review of Current Technical Literature.[1]

SPONTANEOUS DECOMPOSITION OF SUGAR CANE MOLASSES. C. A. Browne.[2] *Ind. and Eng. Chem.*, 1929, 21, No. 6, 600-606.

In January, 1914, the late G. L. SPENCER called the attention of the author, at Central Constancia, Cuba, to a peculiar type of deterioration in tanks of stored molasses. This molasses, which was the final product obtained by the defecation process, was undergoing a constant, gradual loss in sucrose, although there were no apparent evidences of fermentation by yeasts or other biological agencies. The high concentration of the molasses was, in fact, so unfavourable to the growth of micro-organisms that it seemed necessary to attribute the decomposition of the product to other causes. Samples of about 4 kg. each were accordingly drawn from two tanks of the deteriorating molasses and sent to the New York Sugar Trade Laboratory, where they were examined by the writer at intervals over a course of nine years. The results of the analyses of the two samples of molasses show as a whole from year to year : (1) a progressive lowering in the polarization ; (2) a constantly increasing loss of sucrose ; (3) a slow irregular increase in the percentage of invert sugar ; (4) a constantly increasing loss in the total sugars after inversion ; and (5) a constant increase in the percentage of organic non-sugars. Bacteriological examination of the samples in 1914 and on various occasions until 1928 failed to reveal the presence of yeasts, moulds, bacteria, and other micro-organisms. This would indicate that the decomposition must be ascribed to chemical and not to biological causes. In the writer's opinion the deterioration must be regarded as a very slow retarded type of " hot-room " or " froth " fermentation of the sugar-house, in which carbon dioxide, formic acid, acetic acid, and pungent acrid fumes of unknown composition are evolved, together with considerable heat. Another " fermentation " is that sometimes observed in tanks of molasses, also attended by CO_2 evolution, not only as froth on the surface, but also as gas pockets at various depths of the tank (this introducing a considerable error into the measurement of quantity by volume). Similar charges have been observed by the writer in bottled samples which after long storage were transformed into dark porous masses resembling carbonized sugar.

Two explanations of this froth fermentation have been proposed. The first is the formation of glucic acid by the action of the lime used in defecation on the reducing sugars of the cane juice, and this theory is supported by PRINSEN GEERLIGS[3] who showed the content of this compound in cane molasses to be from 0·31 to 7·29 per cent. WINTER[4] isolated a crystalline preparation of glucic acid, but the product was so unstable and impure that nothing definite could be ascertained regarding its chemical constitution. The second explanation is the formation of unstable compounds by the action of the amino-acids of the molasses on the reducing sugars, which reaction has been especially studied by MAILLARD.[5] LAFAR[6] believes this reaction to account for this sugar-house phenomenon. In the opinion of the author, however, while the reaction between amino compounds and reducing sugars no doubt accounts for a part of the losses in total sugars which were noted, the chief cause of the spontaneous deterioration of sugar cane molasses would appear to be the reaction of unstable organic substances, originally produced by the action of lime upon invert sugar, with further quantities of the reducing sugars in the molasses. In confirmation of this explanation, it may be said that it is more particularly the molasses obtained by the defecation process, especially where lime was used in excess, that show a susceptibility towards spontaneous decomposition. Cane table syrups produced by a clarification with lime are also generally the ones that show after sterilization spontaneous decomposition in cans. It should also be stated that the spontaneous destruction of sugars and the formation of organic non-sugars were still found to proceed in the two samples of deteriorated molasses after the disappearance of the " ninhydrin " reaction for amino compounds. Furthermore, the amino acid-reducing sugar reaction fails to explain the formation of the considerable quantities of formic and acetic acids, which are particularly abundant in cane syrup and molasses that have undergone spontaneous decomposition.

2 A brief account of this valuable work has already been published ; see *I.S.J.*, 1928, 559.

3 *I.S.J.*, 1893, 407. 4 *Zeitsch. Ver. Rüben-Zuckerind.*, 1894, 1049.

5 *Comptes rendus*, 1911, 153, 1079. 6 *I.S.J.*, 1914, 184.

PREPARATION OF CANE SYRUP DIRECT FROM CANE JUICE. R. H. Hurst and W. Scott. *Memoirs of the Imperial College, Trinidad*, No. 1, 1929.

A desirable table syrup should have a light golden-brown colour; a density over 80° Brix; and a pleasing, characteristic cane flavour. It should of course be free from turbidity. In a process of making such a product, cane juice is clarified by adding acid phosphate (0·5-1·0 lb. per ton of juice), followed by lime, leaving it "as acid as possible consistent with reasonable clarity of the product," these additions being followed by heating. Sulphitation is not permissible. Evaporation should be carried to 35-40° and if possible to 50° Brix. To avoid crystallization at the final high density, partial inversion, reducing the apparent purity to 35-40°, or somewhat lower if for sale in temperature climates, is necessary. This is best effected by the enzyme invertase of yeast, the syrup at 45-50° Brix, 60°C., and 5·0-6·0 *pH* being submitted to its action in vessels with steam coils and stirring gear over-night for 12-16 hours until the a.p. has fallen to 40° Invertase extract can be prepared by placing clean brewers' or bakers' yeast in stoppered bottles, adding chloroform at the rate of 5 c.c. per lb., and allowing this to stand for a day, when it liquifies, the liquid resulting being used directly without filtration. It may be preserved by adding a layer of toluene to exclude air. Following inversion, the syrup is blended with high-grade molasses (made without SO_2) using up to 12 per cent., this addition being desirable to give the distinct molasses flavour or "sling." Then the mixture is treated with vegetable carbon to reduce its colour (adding 4 per cent. of the solids), agitated at 85-95°C., for 20 min., and pumped through a filter-press. Lastly evaporation takes place in the vacuum pan to 81-82° Brix (cold). Syrup thus obtained should be quite clear and light golden in colour (when viewed through a thickness of 1 in.), being, in fact, refined syrup retaining the characteristic cane flavour, for which product there should be a ready market. Analyses of syrup before and after treatment with vegetable carbon are tabulated, and the results discussed, the outstanding points being that 32 per cent. of alcogel, 41 per cent. of pentosans; 100 per cent. of pectins and 52 per cent. of ash were removed. So high a figure for the ash removal is due to the elimination by filtration of insoluble matter in suspension. Surface tension determinations showed a rise from 41·8 to 65·5 dynes per cm. (water at 30°C. having a value of 71 dynes), which indicates the very efficient removal of colloid material during the clarification process. Such measurements properly carried out and carefully interpreted, it is remarked, should be of considerable value in the elucidation of sugar manufacturing and refining problems.

—

REPORT ON CLARIFICATION AND FILTRATION IN SOUTH AFRICA. Jos. Rault. *South African Sugar Journal*, 1929, **13**, No. 5, 301-303.

As Secretary of the Committee appointed to report on the latest practice in this direction, the author summarizes as follows:—Peck strainers are now used in eight factories, as against three in 1927. Heating the raw juice to about 140°F. (60°C.) before treatment with lime is accepted practice in the majority of the leading factories in S.A. This treatment is justified by a quicker settling, a brighter decanted juice, easier filtration and higher rise in purity from mixed juice to clear juice, and also by improved boiling and curing. The amount of lime for tempering is increasing year by year as shown in the reports of three typical factories covering the past seven years, showing lbs. per ton of cane.

Mill No.	1922	1923	1924	1925	1926	1927	1928
4	4·5	5·2	5·8	6·4	9·8	8·5	9·5
7	4·0	5·0	5·7	8·2	8·5	8·8	9·4
12	3·2	—	—	5·2	4·2	6·9	8·3

The pounds of lime used per ton of cane varies on an average from 7 to 9 lbs. as against 3½ to 5 lbs. a few years ago. The raw juice is sulphited to an average of 2 grms. sulphur dioxide per litre of juice, with even a maximum of 3·35 grms. in one mill reputed for its superior clarification. Phosphoric acid, whether for raw or white sugar manufacture, is an indispensable chemical used to the extent of 0·8 to 2 lbs.

per ton of cane. Clarification by lime and phosphoric acid, with the exclusion of sulphur, has been found impracticable and has now been discontinued in the mills that tried the process in 1926. Importance is being attached to the filtration department, as it is realised that over 2 per cent. of the sugar in the juice is lost in the cake. Attempts are being made to reduce this loss as evidenced by the gradually diminishing sucrose content of the scum cake during the past two years, and higher dilutions of the muddy juice and double pressing are being attempted. Self-discharging rotary vacuum filters are being tried with varying success on sulphitation scums; the Mauss patented filter of the above type is being very favourably reported on by the factory using the carbonatation process. A battery of eight of these filters has been in constant use on the filtration of the first carbonatation muddy juice at this factory. The advantages claimed for the machine in comparison with the plate-and-frame-filter are economy in labour and cloth, cleanliness and decreased sugar losses. These filters work at their best on thickened sludge and should not be considered as filters of high juice capacity, but rather as sludge dryers and sugar recuperators. The average recovery figure of all factories for the past two seasons has now gone up from 78 to 83·01 and 83·90 respectively. It is interesting to show in the following table of actual results obtained in a factory with comparative yearly statements how the purity of juice has a marked influence on molasses formation, sugar losses and recovery :—

Year	Mixed Juice Purity	Weight of Molasses per cent. Cane	Purity Molasses	Sugar in Molasses per cent. Sugar in Cane	Undetermined Losses per cent. Sugar in Cane	Sucrose Recovery from Juice
1925	85·01	2·46	40·97	7·12	4·67	86·29
1926	84·47	2·65	41·32	7·65	4·91	85·20
1927	84·00	2·83	43·56	8·04	5·43	84·80
1928	83·49	3·37	43·48	9·54	5·28	83·65

The Committee records with satisfaction that the control of clarification by the hydrogen-ion method is almost universally adopted in South African sugar factories. As an increase in the lime salts during clarification is to be deprecated, the adoption of the soap test as carried out in beet factories is recommended as a general routine. The Committee also recommends the use of the "Salometer" or other similar apparatus for ash determination by the electric conductivity method. (The two latter recommendations have also been embodied in the Chemical Control Committee Report). Although it was felt that a colloid determination apparatus would be highly desirable for clarification control, the Committee does not feel justified in adopting just yet the new apparatus placed on the market, both on account of cost and lack of local experience with same. The same applied to instruments advertised with the intention of automatically controlling the hydrogen-ion concentration of juices in the factory.

FUEL ECONOMIES IN THE CANE FACTORY. **George W. Connon and G. W. MacPherson Phillips.** *Paper presented to the 48th meeting of the Hawaiian Sugar Planters' Association,* 1928 (here summarized).

In most sugar producing countries a good deal of attention is being given to the more efficient utilization of fuel and steam in the factory, with the object of either generating from the bagasse a surplus of power to be used outside the factory, or producing a surplus of bagasse for sale. In certain cases, where the bagasse is used to manufacture some product such as pulp or fibre board, it may be advisable to operate the factory entirely on purchased fuel; this, of course, calls for high economy of steam and fuel. Several factories in the Hawaiian Islands are now producing considerable amounts of excess power from their bagasse, Ewa being probably the most notable example. A load of from 1400 to 1500 k.w. is being exported from the factory to operate irrigation pumps, which is being done without using any other fuel than the bagasse. Ewa is now operating all but one of its irrigation pumps with electric power produced in the factory. Waialua, Kahuku and some other factories are also operating irrigation pumps by electric power generated from bagasse; this has

resulted in greatly reducing pumping costs. It is possible to increase substantially the heat efficiency of the usual sugar factory, so that either an excess of power can be produced from the bagasse, in addition to what is required to operate the factory, or the fuel consumption can be greatly reduced. In the different examples that are presented by the authors, several different steam pressures with and without superheat have been considered as well as a number of different evaporating systems. Several different combinations of these have been given to find what economies could be obtained by their use, and numerous data are presented. It is shown that superheat alone without any change in the steam utilization system does not reduce the fuel requirements, or the b.h.p. required to operate the factory. Superheat and high pressure by increasing the shortage of exhaust permit the use of various schemes for utilizing the drop of heat level that occurs when live steam is transferred to the exhaust mains. Such schemes are the production of electric power for export from the factory and the employment of evaporating systems that are more efficient than those now in use. These systems reduce greatly the quantity of exhaust required to operate the boiling house, and release live steam for generating exportable power. If power is not wanted, the quantity of steam required to operate the factory is reduced, resulting in the use of less fuel. Other matters which evolve from the data given are : Air-preheaters installed in conjunction with the boiler plant are shown to effect some economy. The application of a high pressure turbine to an old factory will not increase the heat economy. A steam accumulator converts the intermittent flow of steam into a steady flow so that a constant generation of power can be obtained from the steam. Thermo-compressors may be attached to the first cell of an evaporator provided there is extra heating surface to supply the additional vapours required, or may be used in conjunction with a separate cell. Concluding, the authors state that as a general thing, if a highly efficient evaporating system has been correctly selected either for a new factory or for an old factory in which extensive changes have been made, it will probably be found that the higher cost of the evaporating plant (as compared with the usual type) will be more or less offset because both the boiler plant and the condensing equipment for the evaporator will be smaller.

EXPERIMENTS ON TREATING CHAR SWEET-WATERS. **Georg Diehn.** *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, No. 34, 463-464. Sweet-waters washed from char, and used for dissolving up sugar, could be purified by means of the base-exchange " Lux " filter. A sweet-water at 10°Bé. having 48° (German) hardness when evaporated to 62°Bé. gave a brown liquor ; whereas the same sweet-water passed through the filter named till its hardness was reduced to 6° and concentrated in the same way gave a slightly yellow liquor.—DECOLORIZATION IN THE DOUBLE POLARIZATION METHOD. **L. R. Bliss.** *Sugar*, 1929, **31**, No. 5, 195. In analysing very dark molasses using the double polarization (Clerget modified) process, the difficulty in reading the dark inverted solution is well-known. In this connexion the author suggests the use of a reagent consisting of concentrated HCl reduced to 1·10 sp. gr. by saturated chlorine water for use instead of pure HCl, this inverting the sucrose and at the same time bleaching the solution. This appears a suggestion worth investigation.—SUGAR DECOMPOSITION, ITS DETECTION POLARIGRAPHICALLY. **K. Sandera and B. Zimmermann.** *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, 383-389. HEYROVSKY'S polarigraphic method applied to the detection of sugar decomposition on heating in solution or in solid form was found to be highly sensitive in this direction. Curves were obtained indicating that on heating a 26 per cent. solution of sugar from 20 to 100°C. in a boiling water-bath decomposition was incipient after 45 mins. Sugar crystals heated at 70°C. showed but a slight alteration in the dry state, but quite a distinct change in the presence of moisture.—OCCURRENCE OF ZINC IN BEET SUGAR FACTORY PRODUCTS. **O. Spengler and K. Zablinsky.** *Zeitsch. Ver. deut Zuckerind.*, 1929, **79**, 251-262. Eleven samples of German refined sugars showed an average zinc content of 1·9 mgrm. per kilo., examined according to the method used by ROST and WEITZEL.[1] Such an amount cannot be derived from the solution of this metal

[1] *Arbb. Reichgesundh.-Amt.*, 1919, **51**, 494.

from tanks and the like in the refinery, as otherwise it would mean the removal within a few years of all the zinc-lined surfaces, whereas this does not happen. As a matter of fact, zinc surfaces are very resistant to beet sugar juices. The zinc undoubtedly enters in the beet, samples of which were found to contain 2-3 mgrms. per kilo. of this metal. It was also found to be present in different uncooked foods. It escapes precipitation in carbonatation, being present in solution after the first saturation as sodium or potassium zincate, whilst after the second carbonatation it can remain in solution in the alkali carbonates present. It accumulates in the molasses of a raw sugar factory to the extent of 49 mgrms. per kilo., though in refinery molasses the amount of course is less.—DECOLORIZATION OF SOLUTIONS FOR POLARIZATION. **A. M. Schwedow.** *Journal Sacch. Prom.*, 1928, II, 714. In a series of four experiments carried out in the laboratory of the Korjukowka refinery, Ukraine, 13 grms. of after-product were dissolved in water in 50-55 c.c. flasks, made up to 50 c.c. and then to 55 c.c. after the addition of different reagents, viz., (*a*) 5 c.c. of lead acetate, (*b*) ditto, but with 2 c.c. of a 25 per cent. solution of sodium chloride, (*c*) 5 c.c. of lead acetate and 6 drops of a 25 per cent. solution of tannic acid in alcohol, and lastly (*d*) 5 c.c. of lead acetate and 8 drops of a 30 per cent. aqueous solution of pyrogallic acid. After filtration, the colour of each filtrate was measured, and the decolorization was found to be : 67, 79, 85 and 84 per cent. Hence the use of pyrogallic acid in this way is advantageous.—WHITE SUGAR MANUFACTURE : DESIRABILITY OF RE-MELTING. **R. H. Hurst and W. Scott.** *Tropical Agriculture*, 1929, **6**, No. 8, 218-219. Washed raw sugar was remelted to a liquor of 60°Brix, mixed with 1 per cent. of " Suchar " (on solids) for 20 min. at 85-95°C., pumped through a filter-press, and the filtrate boiled to grain, a hard, brilliant white sugar being thus produced. On the other hand, sulphited cane juice, evaporated to 50° Brix, treated similarly with 4 per cent. of carbon, and boiled to grain gave a sugar having a slightly greyish colour. " It is, of course, impossible to produce, at least on a factory scale, a white sugar direct from cane juice equal in appearance to refined sugar, since quite apart from the clarifying action of the carbon, the latter sugar is subjected to the process of re-crystallization. Without the latter process, it appears impossible to free the sugar crystals entirely from their thin films of impurities, which on storage give rise slowly to dark-coloured oxidation products."—CLARIFICATION PROCESS, USING SULPHUR DIOXIDE AND ACTIVATED CARBON TOGETHER. **G. Mezzadroli and E. Vareton.** *Zymologica*, 1929, **14**, 73-104. Treatment of the cold or hot juice with " Norit " even in a medium of 4·0 to 5·2 *pH* produces no inversion, and diminishes the acidity, provided that the organic acids are adsorbed. Sulphitation and subsequent immediate treatment with " Norit " does not give rise to inversion, even at 85°C., since the carbon adsorbs the acidity and the sulphitation decolorizes the juice, renders boiling more regular, prevents formation of froth and lowers the viscosity. —PHASE RULE STUDY OF THE REMOVAL OF SUGAR FROM MOLASSES. **K. Nishizawa and Y. Hachihama.** *Zeitsch. Elektrochem.*, 1929, **35**, 385-392 ; through *British Chemical Abstracts*, 1929, 694-B. — Isotherms of the system involving baryta at 25 and 45° show that the only solid phase besides hydrated baryta and sugar is BaO, $C_{12}H_{22}O_{11}$ which enters into equilibrium with liquid phases the composition of which varies from 4·0 per cent. BaO, 0·16 per cent. $C_{12}H_{22}O_{11}$ to 1·48 per cent. BaO, 31·1 per cent. $C_{12}H_{22}O_{11}$ at 25°, and from 8·99 per cent. BaO, 0·13 per cent. $C_{12}H_{22}O_{11}$ to 1·25 per cent. BaO, 72·52 per cent. $C_{12}H_{22}O_{11}$ at 45°. At 75°, 3BaO, $C_{12}H_{22}O_{11}$ is the solid phase in equilibrium with liquid phases containing from 34·82 per cent. BaO, 0·67 per cent. $C_{12}H_{22}O_{11}$ to 25·08 per cent. BaO, 0·99 per cent. $C_{12}H_{22}O_{11}$, at which point BaO, $C_{12}H_{22}O_{11}$ appears and becomes the stable solid phase until the liquid phase contains 0·48 BaO, 79·06 per cent. $C_{12}H_{22}O_{11}$. In the strontia isotherm, 2SrO, $C_{12}H_{22}O_{11}$ exists in equilibrium with liquid phases containing from 5·99 per cent. SrO, 0·20 per cent. $C_{12}H_{22}O_{11}$ to 4·15 per cent. SrO, 31·31 per cent. $C_{12}H_{22}O_{11}$, and thereafter to 2·26 per cent. SrO, 78·63 per cent. $C_{12}H_{22}O_{11}$ the solid phase is SrO, $C_{12}H_{22}O_{11}$. A brief description of the crystalline form of the various saccharates obtained is given.

J.P.O

Review of Recent Patents.[1]

UNITED KINGDOM.

CRYSTALLIZER.[2] **Duncan Stewart & Co., Ltd.**; 313,290. May 21st, 1928. (Provisional specification communicated by **John E. R. Herisson**, of Central Factory, Verulam, Durban, Natal.)

The invention consists in the provision of improved cooling and stirring arrangements, equally applicable to new and to existing crystallizers. The crystallizer shown in Figs. 1 and 2 comprises the stationary container 2, the shaft 3, extending longitudinally of the container, mounted in bearings 4, 5 and rotated by mechanism 6, and radial stirring arms 7 fixed to the shaft. Leakage of massecuite through the

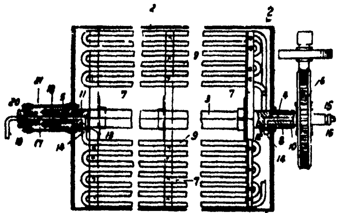


Fig 1

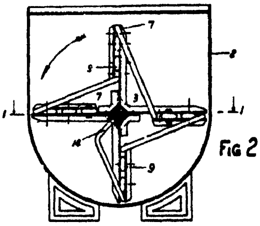


Fig 2

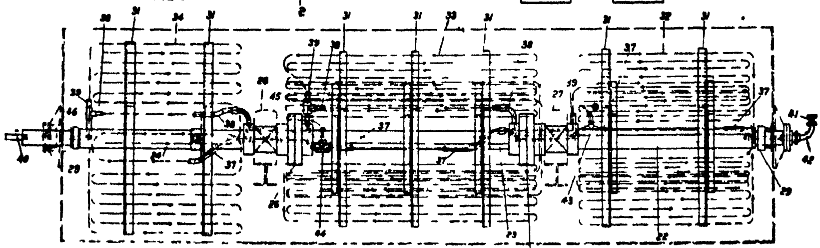


Fig 3

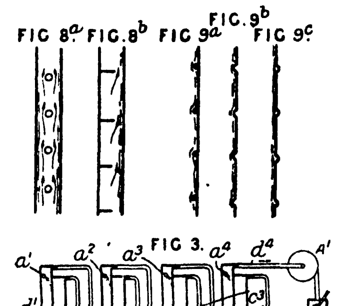
bearing 4 is obviated by means of the stuffing box 8. The bearing 5 is usually closed at the end. According to the invention, the crystallizer is provided with means for cooling the contents of the container consisting of banks of pipes 9 through which cold water or other cooling fluid is passed. The pipes are mounted on the arms 7, and arranged longitudinally so that they make extensive contact with the massecuite and act as additional stirrers. To conduct the cooling fluid to pipes so arranged, the ends of the shaft 3 are formed with axial passages 10, 11 and radial passages 12, 13 to which the ends 14 of the pipes 9 are connected. The fixed inlet pipe 15 enters the end of the shaft 3 to connect to the passages 10 and is packed by means of the stuffing box 16. An outlet pipe 17 screwed into the axial passage 11 extends through a stuffing box 18 fitted at the end of the bearing 5 to prevent the escape of juice around the pipe. The pipe 17 is connected to the fixed outlet pipe 19 by means of a stuffing box 20 carried on bolts 21. In the modified arrangement shown in Fig. 3 there is provided a plurality of sets of pipes spaced lengthwise of the shaft and connected "in parallel" to the supply and exhaust connections for cooling fluid so that the several sets of pipes receive cooling fluid at the same temperature, and the cooling effect is evenly distributed within the container. Referring to Fig. 3, the shaft revolving in the container comprises aligned sections 22, 23, 24 connected by couplings 25 and 26 respectively. The couplings 25 and 26 form journals for central bearings 27 and 28, aligned with bearings 29 provided with stuffing boxes and glands at the opposite ends of the container 2. Each shaft section (partly of polygonal cross-section) carries axially spaced sets of radial angle-irons 31 forming, in effect, stirring

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin Germany.

[2] *I.S.J.*, 1929, 436, 447.

arms, the arms of each shaft section being displaced angularly relatively to the arms of an adjoining shaft section. Sustained by the arms on each shaft section is a coil of piping to be traversed by cooling fluid. In the present instance there are three such coils indicated respectively at 32, 33 and 34. Each coil comprises interconnected banks, the banks of the several coils being staggered, as shown. Each of the couplings 25 and 26 is formed with two through orifices 35, 36, one (35) serving for passage of inlet-cooling fluid and the other (36) for passage of return or exhaust fluid. 37 denotes the main pipe for supply of cooling fluid. 38 denotes the main exhaust pipe.

YEAST MANUFACTURE. **H. B. Wooldridge and P. G. Clark,** of Oakwood Court, London. 312,705. March 6th, 1928. Beet and cane sugar in the form of low grade syrup containing invert sugar, e.g. molasses, are purified particularly for use in the production of a white yeast but also for other purposes. Molasses or sugar liquor is passed as a thin syrup through an ordinary cloth filter press coated with any filter aid, preferably that known as " Celite," " Super-Cel " or " Hyflo." The solution is then allowed to percolate through precipitated alumina, the trihydrate or one of the various forms of bauxite, or magnesium hydrate. In the case of many cane syrups, it is necessary to defecate the weak syrup by boiling it with weak phosphoric acid and neutralizing with lime water before passing it through the filter. The provisional specification states that bauxite may be replaced by other filtering media such as activated carbon or char. (Specification 134,607 is referred to).—FILM EVAPORATOR. **Industrikemiska A.-b.,** of Stockholm, Sweden. 312,089. May 17th, 1929; convention date, May 18th, 1928. Liquids are evaporated in a multiple-effect apparatus in which heat is supplied by a gas-vapour mixture not in contact with the liquid, and the vaporized liquid is removed by a current of non-condensable gas. In a quadruple effect apparatus, Fig. 3, solution is sprayed in at a^1, a^2, a^3, a^4, so as to flow in a thin film down heating surfaces; the temperature of the entering solution is lowest at a^1 and highest at a^4. Air circulated by a pump A^1 flows through the first evaporating chamber c^1 and takes up vapour from the liquid film; it then passes by a pipe d^4 to the evaporating chamber c^2 of the second effect, and the temperature being higher the air absorbs more vapour. The process is continued in the third and fourth effects, and the air-vapour mixture leaves by a pipe d^1 leading to a heater C^4, where it is completely saturated with vapour and raised to a temperature above that of the solution entering at a^4. The hot air-vapour mixture passing by a pipe g^4 to the heating chamber e^4 gives up a portion of its heat to the evaporating film, and then passes at successively lower temperatures through the heating chambers e^3, e^2, e^1, in each of which it gives up a further portion of its heat. Condensate is removed by pipes f^1, f^2, f^3, f^4, The air issuing from the chamber e^1 is finally freed from vapour in a condenser D, and is re-circulated through a pipe H to the evaporating chambers c^1, c^2, c^3, c^4. Concentrated solution is drawn off by pipes b^1, b^2, b^3, b^4, and may be returned, with or without preheating, to the corresponding inlets a^1 . . a^4, or to different inlets as from the outlet b^2 to the inlet a^1. The pressure in the whole apparatus is kept substantially atmospheric by liquid seals as at E, F, G. Intimate contact between the liquid film and the air current may be obtained by baffles and obstructions as in Figs. 8^a, 8^b, 9^a, 9^b, 9^c. Several heating or evaporating chambers may be worked to the rotating drum type of evaporator.—HARVESTING ROOT CROPS. **M. Bardowieck,** of Deinste, near Stade, Germany. 312,941. June 1st, 1929; convention date, June 1st, 1928. The lifting share arranged between the main wheels



is pointed at its front end, and is provided at its rear end with a spreading sole plate so that the narrow and deep furrow cut by the share is transformed into a flat and shallow one. Behind the share a tine wheel rotates, this tine wheel consisting of a series of rods attached to a star wheel on a shaft. Each bar is bent at its free end in a direction opposite to that of its movement so that each row of bars forms a grid separated from the next row by a space through with the roots fall. The free extremity of each bar is bent outwards as a finger that digs slightly into the surface of the furrow behind the share to remove any roots that fall into the furrow without passing into the tine wheel.—FILTERING LIQUIDS. **J. A. Pickard.** **312,944.** December 2nd, 1927. A filter is built up of non-fibrous tapering or stepped, plate-like elements separated to a pre-determined minimum so as to present passages with cross-sectional area decreasing in the direction of flow. Metal elements, 4, Fig. 1, tapering at their edges and circular or rectangular in plan, are superposed in a casing 1 about a perforated outlet pipe 3. Liquid entering the casing through a pipe 2 passes inwardly between the elements, which are spaced apart by protuberances 5 or by ribs, formed on one or both surfaces of the elements, or by spacing washers. Fig. 10 shows a strip element with a spacing ridge 6 and apertures 7 to form the outlet channels. An undulatory strip element may be used in another form. Fig. 15 shows two elements tapering inwardly, the liquid flowing outwardly from the channel 7. Fig. 16 shows an arrangement in which filter-aid 9 is used, the filter-aid being keyed in place against and between the elements. According to the first Provisional Specification, scrapers may be provided between the elements and the elements may be of any suitable alloy or of celluloid, ebonite, glass, wood, or compressed fibre.—DRYING SUGAR BEET. **A. W. F. Capps,** of Dudley House, King's Lynn, Norfolk. 314,907. January 5th, 1928. The latent heat of the vapour generated during the drying of beet by a current of air, etc., is used to heat fresh air entering the drying compartment. The sugar beet is carried through the drying compartment by a conveyor in countercurrent to air which, after passing through the compartment, is heated in the furnace of a boiler supplying a steam engine driving the conveyor and returned through the space above the compartment in which it condenses, the heat of condensation passing through the metal plates separated by sinuous strips to fresh air entering the drying compartment. The air initially entering the compartment is heated to start the drying.—REFRACTOMETERS. **Carl Zeiss,** Jena, Germany. 314,994. July 1st, 1929; July 6th, 1928. Refractometers for liquids, more particularly for use in testing sugar solutions during concentration by evaporation, provided with a deflection device by means of which the boundary line between the light and dark part of the field of view is adjusted to coincide with a fixed mark in the field of view, have the deflection device connected with an indicator and scale whereby the refractive index or the concentration of the solution may be read off against a scale of temperatures.—CLEANING CANE. **Ralph S. Falkiner,** of Melbourne, Australia. 314,364. March 26th, 1928. Cane in small pieces is fed into a water tank 1 having an endless moving conveyor 3 in the tank adapted to remove the heavy or good cane from the bottom of the tank and a similar conveyor adapted to remove waste material floating on the water. A pump 6a is used to circulate the water and force the material to the appropriate conveyor. In a modification the conveyors are mounted in a circular channel in which water is caused to circulate.

FIG 10.

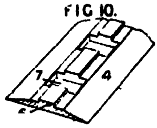


FIG.15

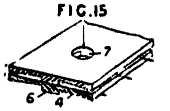


FIG.1.

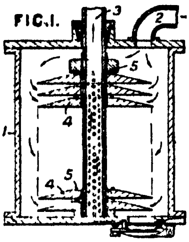


FIG 16

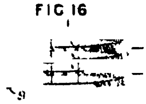
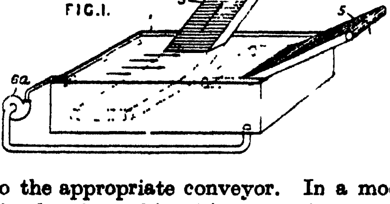


FIG.1.



UNITED STATES.

IMPROVEMENTS IN PRODUCING MOTOR FUEL. **Jos. H. James,** of Pittsburgh, Pa., U.S.A. 1,716,272. June 4th, 1929. A motor fuel comprises denatured alcohol and miscible oxidized kerosene.—CANE MILL. **William L. Beall,** of Chattanooga, Tennessee (assignor to **The International Harvester Co.**). 1,709,552. April 16th, 1929. Claim is made in a cane mill (having a vertically disposed shaft, presumably of small-scale type) for the combination of a body, a main feeding roller journalled for rotation in the body, a supplementary feed roller also journalled for rotation in the body, said supplementary roller being fluted longitudinally on its surface, said flutes being continuous and stopping short of the ends of said roller.— BEET TOPPER. **Oswald H. Hansen** (assignor to the **Hansen Canning Machinery Corporation,** of Cedarburg, Wis., U.S.A.). 1,718,954. July 2nd, 1929. In combination, a pair of co-operating rolls rotatable in opposite directions to remove appendages from objects travelling therealong and disposed to deliver the treated objects over the corresponding ends thereof, and means providing supporting bearings located entirely within said rolls and shielded from contact with the objects treated by the rolls.—CENTRIFUGAL MACHINE. **Eugene Roberts** (assignor to **The Western States Machine Co.,** of Salt Lake City, Utah, U.S.A.). 1,719,132. July 2nd, 1929. In a centrifugal apparatus, the combination is claimed with a centrifugal and its driving means, of a starting lever adapted to be shifted to normal operative position at the will of the operator, a sprayer, a controller set in operation by the movement of said lever to operative position, said controller having three adjustable elements acting respectively to start and to stop the sprayer after predetermined but variable intervals, and to shift the lever to idle position to allow the centrifugal to stop.—REVIVIFICATION OF USED KIESELGUHR. **Robert Calvert,** of Lompoc, Cal., U.S.A. 1,717,661. June 18th, 1929. Claim is is made for the process of revivification of wet filter cake from sugar refineries which consists in disintegrating the filter cake by means of a blower, in a stream of hot gas containing oxygen, blowing into a chamber maintained at a higher temperature than prevails in the first-mentioned blower, exhausting the chamber with a second blower, and then separating the dust from the gas.—PREPARATION OF CELLULOSIC MATERIAL (FIBRE AND PULP PRODUCT). **Robert A. Marr,** of Norfolk, Va. (*A*) 1,717,794, 1,717,795. (*B*) 1,717,795. (*C*) 1,717,796. (*D*) 1,717,797. (*E*) 1,717,798. (*F*) 1,717,799. (*G*) 1,717,800. June 18th, 1929. (*A*) Claim is made for a process of preparing cellulosic and ligneous materials for pulping which comprises cooking the same in a solution of an alkali-forming metal sulphate of about 0·05 to 0·2 per cent. strength, figured as anhydrous salts, until the cementitious matter in said cellulosic and ligneous material, while retaining its initial physical structure, is rendered readily friable by pressure, without thereby reducing such material to a pulp. (*B*) A process which comprises cooking cellulosic and ligneous material in a solution containing sulphates of magnesium and potassium with a chloride. (*C*) A process of producing pulp which comprises subjecting a cellulosic material to a partial cooking treatment, by digesting the same in a 1 to 5 per cent. solution of a normal salt of an alkali-forming metal, such salt being derived from an acid which is stable at the temperature of the digesting operation, continuing this treatment until the cementitious matter is rendered readily friable, but not until the said material has been reduced to a pulp, the digestion being at a temperature sufficient to produce a caramel odour in the liquid, and thereafter reducing the material to a pulp by mechanical treatment. (*D*) A process which comprises boiling cellulosic and ligneous material with a dilute aqueous solution of a soluble nitrate, soaking in water and mechanically reducing to a pulp. (*E*) A sheet of plastic plant growth, containing substantially the full water-insoluble content of the plant growth, including the lignin, fibro-cellulose and inter-cellular cementitious material, the individual fibres being entirely separated and each having its outside individual sheath of lignin, the fibres being substantially of uniform type throughout the sheet, and the individual fibres being substantially unbroken and of natural shape and size, such product being free from zinc compounds and being substantially stronger than any kind of mechanical pulp. (*F*) A process of treating cane material of the character set forth which comprisesd igesting the same in a solution containing an alkali metal sulphate and zinc

sulphate.—EVAPORATOR. **Burton S. Hughes and Stanley Hughes**, of Buffalo, New York, U.S.A. 1,717,927. June 18th, 1929. An evaporator comprises a body having an upper chamber and a lower chamber, said lower chamber being adapted to contain the charge of material to be treated, a heating unit interposed between said chambers and including circulating tubes for the downward passage of material opening at their ends into said chambers, means extending upwardly through the evaporator body for delivering the material from the lower chamber into the upper chamber, and a vapour discharge tube extending through the heating unit and opening at its upper and lower ends into said chambers, respectively.—ARTIFICIAL BOARD MANUFACTURE. (*A*) **Clarence C. Vogt.** 1,718,011. June 18th, 1929. (*B*) **Clarence C. Vogt and Ernest J. Pieper,** of Haddonfield, New Jersey, U.S.A. (*A*) The process of making board from plants as described comprises cooking the plant material and mechanically separating the fibres so as to produce a fibrous mass saturated with a water solution containing the natural binder of the plant fibres, adding to the mass a phenolic body and forming it into board form, and baking the board to form a water-repellent phenolic condensation product binder from the natural binder. (*B*) The process of making board from plants of the character described, cooking the plant material and mechanically separating the fibres so as to produce a fibrous mass saturated with a water solution containing a natural binder of the plant fibres, adding to the mass a phenolic body together with a water-insoluble toughening agent and forming it into board form, and baking the board to form a water-repellent phenolic condensation product from the natural binder.—FILTERING DRUM. **Jean B. Vernay,** of Villeurbanne, France. 1,720,156. July 9th, 1929. A filter, comprises a drum around which the filtering cloth is to be wrapped, said drum being divided into independent sectors each comprising a plurality of individual blocks, each block having a set of grooves in its outer surface and a single channel cross-connecting such grooves and disposed inwardly of the plane thereof, the channels of any two successive blocks registering endwise; separating means between the successive sectors; means for uniting the sectors together to form the drum; and a radial pipe individual to each sector, said pipe opening into the channel of one of the blocks forming the sector and leading from said block to the distributing gear.—LIQUID CLARIFYING APPARATUS. **Harry Miller,** of Okmulgee, Okla, U.S.A. 1,720,185. July 9th, 1929. A liquid clarifying apparatus comprising a trap having a liquid inlet and a liquid outlet, a charge tank having a liquid inlet and a liquid outlet, means placing the liquid outlet of said trap in communication with the liquid inlet of said charge tank, an agitating tank having a liquid inlet and a liquid outlet, means placing the liquid outlet of said charge tank in communication with the liquid inlet of said agitating tank, a washing tank having a liquid inlet and a liquid outlet, means placing the liquid outlet of said agitating tank in communication with the liquid inlet of said washing tank, a precipitating tank having a liquid inlet and a liquid outlet, the latter being between the liquid level and the tank bottom, means placing the liquid outlet of said washing tank in communication with the liquid inlet of said precipitating tank, a filter having a liquid inlet and an outlet, and means placing the liquid outlet of said precipitating tank in communication with the liquid inlet of said filter.—BEET THINNING MACHINE. **Herman H. Boettcher,** of Blue Earth, Minn. 1,720,409. July 9th, 1929. A machine of the class described comprises a frame supported for travel, a pair of endless rails arranged parallel to each other and at an angle to the line of travel of the machine in said frame, means connecting the rails with the frame to provide for relative adjustment of the rails transversely of the frame, blade supporting members extending transversely with respect to the rails and to the line of travel of the machine and arranged in an endless series, blades supported by said members, means for imparting motion to the series of blade supporting members and the blades carried thereby at a rate of speed such that the lower stretch of the series of members will travel in the direction opposite the direction of travel of the machine and at a rate of speed equal to the speed of travel of the machine, and operative connexion between said rails and said blade supporting members for effecting movement of the members and the blades carried thereby in a direction transverse to the line of travel of the machine.

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons		1928. Tons.
Total Receipts, Jan. 1st to August 24th	2,548,081	..	2,109,305
Deliveries " "	2,239,558	..	1,938,527
Meltings by Refiners " "	2,104,743	..	1,831,865
Exports of Refined " "	64,000	..	62,936
Importers' Stocks, August 24th	406,754	..	279,318
Total Stocks, August 24th	606,293	..	385,791
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT JULY 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	2,591,791	..	2,119,500	..	3,306,268
Stocks	998,210	..	1,016,592	..	978,543
	3,590,001		3,136,092	..	4,284,811
Local Consumption..	81,000	..	51,165	..	53,971
Receipts at Ports to July 31st ..	3,671,001	..	3,187,257	..	4,338,782

Habana, July 31st, 1929. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(Willett & Gray's Estimates to August 29th, 1929.)

	1928-29. Tons.		1927-28. Tons.		1926-27. Tons.
CANE.					
America	9,120,149	....	8,152,029	....	8,607,027
Asia	7,274,942	....	6,891,715	....	6,353,682
Australasia	640,034	....	588,163	....	484,682
Africa	721,285	....	656,360	....	600,997
Europe	—	....	9,000	....	6,719
Total Cane	17,756,410	....	16,297,267	....	16,053,107
BEET.					
Europe	8,358,799	....	8,031,874	....	6,871,892
U.S.A.	938,640	....	965,241	....	801,246
Canada.............	28,857	....	27,212	....	31,422
Total Beet	9,326,296	....	9,024,327	....	7,704,560
TOTAL CANE AND BEET....	27,082,706		25,321,594		23,757,667

United Kingdom Monthly Sugar Report.

Our last report was dated 14th August, 1929.

During the last month a period of inactivity has been experienced. The trade has continued to hang back waiting for something to turn up to stimulate their appetite.

The decree establishing the single selling agency eventually came into force on September 1st, but so far the syndicate has kept out of the market desiring by this means to obtain a price of 2¼ cents c.i.f. New York, which they consider the lowest price at which they would sell. The world was very sceptical as to the ability of this pool to enforce this price, but during the last few days greater strength has manifested itself in America and to-day the price of 2¼ cents has actually been paid and it is reported there are buyers at this price.

There is nothing fresh to report regarding the Brussels Conference, where the various parties interested are still awaiting the reply from Java as to whether the producers in the island will co-operate in the scheme of stabilising the production over the next few years.

On the London Terminal Market the raw section has been quiet, and prices have only fluctuated in a narrow margin until the last two days December moved from 8s. 5¼d. to 8s. 3d. to 8s. 9¾d., March from 8s. 9d. to 8s. 6d. to 9s., May from 9s. 0¾d. to 8s. 11¼d. to 9s. 4½d. and August from 9s. 4½d. to 9s. 2¼d. to 9s. 9d.

In the White section business has been very limited. The August account was liquidated as low as 10s. December sold down to 10s. 8¼d. and up to 11s. 1½d. March sold from 11s. 1½d. to 11s. 9d., May from 11s. 6d. to 12s. and August from 11s. 9d. to 12s. 3d.

The latest prices are :—

	SEPTEMBER	DECEMBER	MARCH	MAY	AUGUST
Raw	8s. 3d. ..	8s. 9¾d. ..	9s. 0d. ..	9s. 4½d. ..	9s. 9d.
White ..	10s. 6d. ..	11s. 1½d. ..	11s. 7½d. ..	12s. 0d. ..	12s. 3¾d.

Actual sugar has been very slow of sale. Refiners reduced their prices by 3d. on August 15th, 3d. on August 22nd, and 3d. on August 29th. They advanced them by 3d. on September 4th and 3d. on September 10th, to-day's prices being No. 1 Cubes 27s., London Granulated 23s. 10½d.

Raws have been sparingly offered and business to the Refiners has been confined to parcels of Peruvians and Cubans at 8s. 4½d. to 8s. 8½d. c.i.f. The first hand price is however, in the neighbourhood of 10s. c.i.f.

The Java Trust have now sold the whole of their output for this crop. The last sales took place this week at 13 Guilders for Whites.

The weather in Europe has not been so favourable lately as in the earlier part of the summer. A long spell of fine weather has given rise to a certain amount of anxiety, and it is doubtful now whether the crop will reach last year's figure.

21, Mincing Lane,
London, E.C.3.
16th, September, 1929.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 370. OCTOBER, 1929. VOL. XXXI.

Notes and Comments.

The Outlook.

The prospects for an improvement in the economic position of the world sugar industry in the coming crop year seem on the whole distinctly better. The tale of dissatisfied countries is being added to, and it is realized that the most handy remedy to apply is that of crying a halt to increases in output. This is being proposed in individual cases, e.g., in South Africa, while adverse climatic and other factors are bringing about an actual reduction in the output of others, Java and Cuba for instance. The 1929-30 world's output therefore promises to show a decided decline on earlier estimates, if not an actual decrease as compared with 1928-29. The European beet crop adds its quota to the probability, for the prolonged drought there has affected the beet fields and the rains have come at a stage when it is problematical whether they will do any good. In 1929 eleventh-hour rains unexpectedly improved the yield of the fields, but this season the relief comes at a still later stage and may not prove so effective.

In the meantime, LICHT has issued his first forecast of the beet crop, and his table shows a decrease for Europe omitting Russia of some 217,327 metric tons of sugar as compared with 1928. Germany, Holland, Rumania and the Scandinavian countries show the principal decreases, while it is thought in some quarters that LICHT's figure for France (a slight increase over last year) is over-optimistic. Even allowing for the last minute rains proving beneficial, it seems evident that the European crop this year will register a decrease as compared with that of 1928. As for Java, the earlier hopes of further augmentation of output have been long since abandoned and 2,900,000 long tons seems about the most to expect. The three-million-ton mark was missed last year by a narrow margin and will be missed again this year, it seems. In Cuba the drought in the earlier months of the year, and a general lack of money for cleaning and cultivating the fields, have contributed to a reduction in the estimated 1930 crop by half-a-million tons as compared with 1929. Our Cuban correspondent puts the expected output at 4,650,000 Spanish long tons or just under 4,700,000 long tons avoird. Finally, we may note that the latest figures from Formosa indicate a small reduction in the coming crop, due to a decrease in acreage planted. On the whole, then, the indications offer the market some definite inducement to come out of its slough of despond in the near future. But the market has been for so long

impervious to favourable breezes that it may take something more than the present freshening of the wind to stimulate a recovery.

The political output in several quarters remains unsettled. Geneva continues to examine the sugar economic question, and has just addressed a circular letter to the various Governments concerned, with regard to their excise duties on sugar. She believes that at least a partial solution of the present difficulties lies in a further and more rapid increase in consumption, and she therefore presses the view that excise duties on sugar which in some instances are strikingly high could be reduced without diminishing the revenue derived from the tax, inasmuch as a reduction in duty might well lead to a considerable increase in consumption. The Governments are given till the end of March next to consider the matter and express their opinion. The long period allowed for the reply suggests that the Geneva Economic Committee has reason to hope that the governments concerned will be disposed to go into the matter thoroughly.

The negotiations at Brussels between Cuban and certain European interests remain shrouded in mystery, and there is no further indication as to what Java's final decision will be. Our Cuban correspondent avers indeed that the proceedings have been hushed up because American political circles suspected the attempted formation of a world sugar trust, and applied the supposition as an argument in the welter of discussion over the American sugar tariff bill. The last will have to come before Congress in its ordinary session beginning in December, the special session having failed to dispose of a very thorny and politically contentious subject. So the unsettlement of the sugar market by this pending legislation seems bound to continue for a considerable while yet.

It will be noted from our article on Cuba on another page that the operations of the single selling agency in that country are already bearing fruit and promise to be a success. As a matter of fact, Cuba is determined to get as much of the 44-points preference as she can, and on the small amounts of sugar she has been letting go lately she has made a price to America that has shown about 20 points advantage. The real tussle will, however, not begin till the new crop comes on offer.

The West Indian Sugar Commission.

Since our last issue, the remaining appointments to the West Indian Sugar Commission, which is to visit the West Indies to enquire into the cause of the present depression there and suggest remedies, have been announced. Mr. D. M. SEMPLE is to be the other Commissioner in addition to Lord OLIVIER; Mr. J. A. JONES, the Assistant Commissioner of Agriculture for the West Indies, is to act as Adviser ; and Mr. SYDNEY CAINE of the Colonial Office is to be Secretary. In addition, Mr. GEOFFREY EVANS, principal of the Trinidad College, will attend the sittings in Barbados. LORD OLIVIER has had a varied official experience in the West Indies, culminating in the post of Governor of Jamaica. Mr. SEMPLE's appointment is of considerable interest and should ensure that the technical side of the sugar industry in the West Indies receives adequate investigation and recognition. Since 1924 he has been associated with the Mirrlees Watson Co. Ltd., of Glasgow as deputy for Mr. W. SCOTT HERRIOT ; but prior to that he had an extended career in Hawaii and the Philippines. Born and educated in Aberdeen, he served an apprenticeship to an engineering firm in that town, and then went out to the Hawaiian Islands where from 1912 to 1920 he worked in the engineering branch of the sugar industry, finishing as Works Manager of Catton, Neill & Co., of Honolulu.

For a year or two thereafter he managed that firm's branch in the Philippine Islands, and then from 1921 to 1924 he was General Manager of the Philippine Sugar Centrals Agency (formed to supervise the running of six sugar centrals in which the Philippine National Bank was interested). Since 1924, as above mentioned, he has been associated with the well known Scotch firm of sugar machinery manufacturers, being in fact the most eminent addition to their staff of late years. In Hawaii he was considered a man of outstanding ability, many men considering him one of the best all-round engineers in the islands ; and this reputation he carried to the P.I. and more than maintained there. To his new task he therefore brings an exceptionally wide knowledge of his subject that should stand the Commission in good stead in judging how far the difficulties under which the British West Indian sugar industry suffers are due to inherent defects of technique, and how far to causes that require remedies of a different order.

* * * *

The *Jamaica Gleaner*, discussing the point that the Commission will after all include Jamaica in its tour, remarks ; " When we remember that the conditions of the sugar industry of Jamaica are not quite the same as those of the industry in the other Colonies, it will be generally agreed that the Commission should not leave Jamaica out of its itinerary . . . . It is well known that the Governor of Jamaica is keenly desirous of not having bananas alone as the foundation of our prosperity . . . We wish to foster a sugar sense in Jamaica ; for though bananas are flourishing, the Panama Disease still progresses, and drought and hurricane affect bananas as they can never affect the cane. Besides, we are as large a producer of sugar at present as is Trinidad. Trinidad does not make more than between 40,000 and 60,000 tons of sugar per annum, and the estimate of our sugar production for this crop is very nearly 60,000 tons. It is quite true there are reports that the United Fruit Company will abandon sugar ; but there is no certainty whatever that the United Fruit Company will entirely abandon sugar ; what is at present indicated is a diminution of the volume of sugar formerly produced by the Lindo Brothers, but by no means the abandonment of the sugar industry in Vere."

The British Beet Industry from the Financial Point of View.

It is often interesting and instructive to read the opinion of the financial press with regard to the economic prospects of an industry. It may or may not gauge accurately the merits of divergent technique in a given trade, but the financial side of the business is as a rule fairly well appraised. The *Financial Times* has lately been analysing the results of the principal undertakings in the home beet sugar industry for the past two seasons, and these are embodied in a Table which we reproduce by permission on another page. Our contemporary devoted a leading article the other day to discussing these results. It remarked at the outset that " some aspects of the home grown beet sugar position appear to support the view that there is a reasonable chance of the industry winning through." But " the nature of the figures disclosed in respect of the past season leaves no room for doubt that if finality in treatment methods has been reached, the prospect, when public funds cease to be available as a prop, must be regarded as distinctly unpromising, and that if improvements of organization and extraction can be and are to be embodied in practice, the sooner the factories set about the task of securing them the better."

Our contemporary points out that when the Table (given elsewhere) is studied, it is apparent that the aggregate trading profits of the groups, before

allowing for depreciation, were £1,127,800. As against this sum the public records show that during the same period there was a grant made out of the sugar subsidy to the amount of £2,909,300. "It is manifest from these statements that the manufacturing side of the beet sugar industry in this country is not making the progress for which we had hoped. With two or three exceptions net profits last season shrank, and in some instances markedly so, that the general rule is that where dividends have been paid they have not been earned." The factories admittedly have had their troubles. They had had to face a reduction of the subsidy and also guarantee prices at their own risk to the farmers. "Fortunately the current year promises better conditions, both as regards acreage under beet and its sugar content. It still leaves to be solved the problem of ensuring maximum working for the factories at minimum overhead costs, upon which the future of the industry must depend for permanently successful work." . . . "Thanks to the large depreciation allowances now being made, the factories will be able to re-capitalize, if necessary, by the time the subsidy ends, but they should not lose sight of the much more vital fact that a real drive after technical improvements now is the best guarantee of safeguarding raw supplies and of demonstrating in 1934 that the subsidy has achieved its object. It would be a profound pity if, by pursuing any other policy, the British factories dropped a few years hence into the position of adjuncts to the Dutch beet industry, but that is a clear possibility if advancement in methods is allowed to lag. Failure would not be wholly the fault of the farmer."

* * * *

It may be added that since the analysis above referred to was published by our contemporary, a Government White Paper has been issued giving the results of the balance sheets of the 15 companies operating in this country under the British Sugar (Subsidy) Act. The profits made are shown as varying between £903 in the case of Selby Factory and £100,000 in the case of Cantley. The balance sheet of the Sugar Beet and Crop Driers Ltd., running the Eynsham factory, shows neither profit nor loss. Among the assets appears a sum of £249,468 for "patents, patent rights and cost of research."

But the *Financial Times* remarks that the profits shown in most instances include the balance brought in from the previous account, and obscure the fact in some cases that a loss and not a surplus was made on the actual year's working ; the real showing of the various concerns is better demonstrated by our contemporary's analytical table reproduced on page 557. As a simple matter of fact, it declares, none of the companies could show a surplus but for the subsidy.

Dumping in South Africa.

Cable advices to the *Times* and other papers from South Africa indicate that the Natal sugar industry is being more or less severely hit by the dumping of imported sugar into that country. Foreign sugar is arriving by the truck-load and is being sold at a couple of shillings per pocket less than Natal sugar, in spite of the duty of 8s. per cwt. levied on it. As a consequence, producers are being forced to accept £14. 2s. per ton for their sugar, although £15. 6s. per ton is the approximate cost of production as recognized by the Board of Trade. Most of the imports come from Czecho-Slovakia and Cuba.

On ordinary refined sugar going into South Africa the import duty of 8s. is made up of 4s. 6d., plus a "suspended duty" of 3s. 6d. which has been in operation for about three years. More recently the South African Government have proposed the application of a dumping duty in terms of the

dumping clause of the 1925 Customs Act calculated to neutralize the cut price of the dumped sugar[1]: but it does not appear that they have yet put it into operation, or are resolved as yet to do so, though negotiations have taken place between the industry and the Government on the matter. Meantime the Cane Growers' Association of Natal has met and discussed the possibility of evolving a workable scheme to prevent the indiscriminate increase in cane planting, irrespective of the market available. This would indicate that South Africa too wishes to call a halt in output till market conditions and prices are more favourable for the expansion of the industry.

Indian Sugar Production in 1927-28.

In our June issue we gave the official account of the Sugar Trade of India during the year 1927-28, as prepared by the Sugar Bureau at Pusa ; but as is customary with these reports the figures of production of gur and sugar are only given to the previous year. Some figures now published in a Calcutta paper, *Commerce*, supply the data for the 1927-28 season, from which we take the following figures. In the year in question out of 30 concerns that refine gur by modern methods only 19 were at work, and of these 14 had been in continuous operation for some time while the other five undertook refining operations either for the first time or after discontinuing in the previous season. The total amount of gur melted during 1927-28 came to 1,415,926 maunds or 51,959 tons, which compares with 1,591,997 maunds or 58,380 tons in the previous season (1926-27) ; the amount of sugar made direct from cane came to 67,684 tons as compared with 62,941 tons. The total production by modern processes therefore works out at 119,643 tons for 1927-28, as compared with 121,321 tons in the previous year, and with 91,400 tons in 1925-26. The quantity of sugar refined from gur in 1927-28 therefore shows a marked decrease, and it does not appear probable that in the near future gur refining will be able to make any better showing.

West Indian Crop Reports.

The following is the gist of Barclay's Bank reports on the British West Indies during the last four months. *Barbados*.—During the last quarter the rainfall has not been sufficient for the needs of the growing crops ; welcome showers fell in July and August but were not enough to bring the rainfall up to the average, in view of the severe drought conditions prevailing this year. The crop just finished has amounted to 66,275 tons of sugar and the equivalent of 15,945 tons of molasses, or a total of 82,220 tons. *Trinidad*.—During May the weather was favourable for grinding, but the wet season set in early in June and heavy rains resulted in the reaping being curtailed in some instances and the remaining canes left over. During July and August the weather was seasonable and the young cane growth has benefited. The 1929 crop which has now been reaped establishes a record with a production of 89,858 tons, the best previous ones having been 1928 with 81,551 tons and 1887 with 79,010 tons. The juice quality has proved very high. In spite of the low price of sugar it is satisfactory to record that the standard of cultivation has been maintained. *Jamaica*.—During May the dry weather was favourable for grinding, but rains were wanted badly for the young cane. Seasonable rains fell in June, but in July dry weather was again experienced. *Leeward Islands*.—For the quarter ending with May the weather was dry in Antigua and good rains did not fall till July. In St. Kitts the effect of the dry weather was less pronounced. In both cases the 1929 production has been considerably curtailed owing to the effects of the hurricane that visited

[1] See *I.S.J.*, 1929, 466.

the islands last September. The St. Kitts crop only attained to 13,724 tons, as compared with 19,493 tons last year; and Antigua produced 10,730 tons which compares with 19,668 tons in 1928. *British Guiana*.—The sugar canes reaped in April were affected by the drought which had prevailed earlier; the sucrose content was reported satisfactory, but the canes were short and lacked body and the returns, consequently, were poor. In June the weather was seasonable with heavy rains, which continued during the subsequent two months. The 1929 crop is estimated at 109,200 tons.

Cane Sugar Company Reports.

J. L. HULETT & SONS.—For the year ended April 30th last this well-known Natal tea and sugar firm made a net profit of £159,682 as compared with £134,563 in 1927-28, and a dividend of 15 per cent. is being paid on the ordinary shares. The total quantity of sugar manufactured, exclusive of sugar in process, amounted to 82,227 tons, an increase of over 13 per cent. on the preceding season and exceeding the previous best by nearly 10,000 tons. The net return to the mills per ton of raw sugar of 96° was £15. 8s. 5d., as compared with £16. 2s. 0d. for the previous season, being a reduction of 13s. 7d. per ton. The increased quantity of 10,000 tons manufactured may be mainly attributed, states the Report, to the encouragement afforded to planters by the Fahey Conference Agreement to deliver a better class of cane to the mills, resulting in a lesser quantity of cane to make one ton of sugar, whilst the lower prices were to a great extent counteracted by the higher efficiency of the mills, resulting from past expenditure on machinery, and assisted also by the larger output. It was anticipated that with the increase of the import duty in 1926 to £8 a ton a more stable condition of the industry would result, but the directors report that during the past 12, and particularly the last 6, months this stability has been impaired, owing to the low prices that have ruled in the world sugar markets. Sugar producing countries have generally maintained high prices within their own borders and disposed of their surplus to other parts of the world at such prices as the depressed market conditions would allow. South Africa, we are told, having the smallest protective tariff of any sugar producing and consuming country naturally attracted attention, with the result that consignments of Continental and American sugar found their way into the South African market at prices not only lower than those ruling in South Africa, but considerably below those realized for the same quality of sugar in the country of origin. The effect on the South African market has been that stability has been impaired and a correspondingly larger quantity of cargo sugar has had to be exported to the United Kingdom and sold to the refiners at the world's current rates.

SENA SUGAR ESTATES LTD.—For the 1928 season the total production of sugar amounted to 62,236 tons, which was over 25 per cent. more than in 1927. At the same time the acreage cropped was 2,145 acres less. The purity and sugar content of the juice were better than in the previous season, with the result that the average number of tons of cane required to make a ton of sugar had decreased to 10·12. The result of the year's working was a profit of £71,643 which compared with £87,957 in 1927. As a result the Company are unable to recommend the payment of a dividend on the ordinary shares. It is pointed out that the average proceeds were £2 a ton less than in 1927, and this on the output represents as much as 10 per cent. dividend on the ordinary shares.

The Situation in Cuba at the Beginning of Sales Control.

By EARL L. SYMES.

Weather conditions in Cuba have continued favourable for the growing cane, although the total rainfall to the end of August, 1929, is somewhat less than in previous years, excepting that of 1927. The following table will give an idea of how this has varied.

TOTAL RAINFALL, INCHES, EIGHT MONTHS JANUARY TO AUGUST, INCLUSIVE.

Province	1925	1926	1927	1928	1929	Normal	1929 June, July, August
Pinar del Rio	40·73	32·26	19·77	26·15	32·32	39·54	21·28
Havana	38·69	41·99	25·40	30·23	34·81	36·13	21·21
Matanzas	54·44	49·81	29·81	36·29	32·76	40·17	24·20
Santa Clara, North	45·56	46·89	21·57	30·65	27·75	34·17	18·79
Santa Clara, South	39·52	38·56	26·12	36·04	32·53	35·43	24·96
Camaguey, North	40·04	42·59	21·37	28·34	27·38	34·31	20·67
Camaguey, South	39·56	43·35	25·31	35·94	31·72	30·78	25·18
Oriente, North	28·96	27·25	19·05	28·65	19·91	21·57	14·68
Oriente, South	34·18	33·20	23·36	31·07	24·56	29·81	16·18
General Average Cuba	39·85	39·66	24·10	32·61	29·27	33·87	20·89

It will be noticed that 70 per cent. of the rainfall to the end of August came in the three months, June, July and August, whereas the normal precipitation is usually almost equally divided between the first five months and the next three months of the year. The present unequal distribution, consequently, gives us less benefit, due to excessive run-off. The appearance of the ratoon cane fields bears out this conclusion, since their development is quite subnormal. This backward condition in addition to the decadence brought on in many sections, owing to the lack of money for cleaning and cultivating the fields, makes the previous forecast of the coming crop to produce around 4,650,000 long tons Spanish weight of raw sugar, continue in effect. Other recent predictions have not exceeded this amount by more than 100,000 tons.

The subject of paramount interest and importance in Cuban sugar circles at present is the Co-operative Export Agency lately created by Governmental Decree and functioning since the 1st of September under the name of the old Cuban Export Corporation. Meetings of the stockholders of the C.E.C. will be held during the next few weeks, when changes in the by-laws will be made so that it may function as a so-called Co-operative Export Agency.

The various Provincial organizations of mill-owners and cane-growers are now beginning to wake up, and have published resolutions requesting that their members be drawn on for an enlarged directorate to guide the affairs of the new C.E.A. Since the inception and present management of the Cuban Sales and Sugar Defence organizations seem to be under the influence of one or two men, it may be a wise policy to provide for a sub-division of authority in the reorganization about to be effected. Press comments on Colonel TARAFA, one of the leading lights in the control of the Single Sales Agency, do not inspire any great confidence in his performances as a soloist. It is recalled that his open-hearted offers and conversations in Europe in 1926 led to the governmental imposition of crop restrictions which failed to bring any great benefit

to Cuba, and, in fact, actually deprived the native Cuban field and factory workers of several millions of dollars in earnings due to the limiting of their working days. His later conversations in the United States with Western beet producers brought nothing but a concerted effort to increase the tariff against Cuban sugar. His recent activities in Washington in July resulted in his recommendation of the Co-operative Export Agency. In August the European negotiations by one of Colonel TARAFA's lieutenants caused rumours that by controlling the sale of all Cuban sugar and attempting to form an export agreement with Java and European producers, the Cubans would be leaders in a World Sugar Trust that would fix prices to suit their needs. This provided additional arguments for the High Tariff advocates in the United States, with the result that the doings of the Conference in Belgium were hushed up, and it is probable that concerted action has been postponed until a more propitious time. The complaint of the U.S. beet growers that Cuban sugar was produced by cheap labour induced Colonel TARAFA, who had been fighting an increase in the Tariff on the grounds that Cuban producers were losing money, to return to Cuba and order an increase of 25 per cent. in wages for the workmen on his sugar plantations. This news item was gleefully received by the High Tariff henchmen, who reminded the doughty Colonel that he could not be losing much money if he could raise wages 25 per cent. When the Senate Committee reduced the House rate from 2·40 to 2·20 on Cuban raw sugar, Colonel TARAFA, returning triumphantly from Washington, was met at the wharf in Havana by many and important personages to whom he confided that the final rate would be 1·80 instead of 2·20. This statement probably caused still greater pressure to be exerted by the United States cane and beet farmers who are now calling for derogation of the Cuban Reciprocity Treaty.

One other error of Colonel TARAFA and his Sugar Defence committee-men may be cited : in drawing up the articles for the creation of the C.E. Agency, Article No. 8 was inserted providing for sales of Cuban raw sugar to " Refiners of the United States of North America " on a toll basis for export as refined. It is difficult to understand why this marketing of Cuban raws as refined should be limited to U.S. refiners, when their harsh and unfriendly treatment of Cuban sellers is remembered. Instead of reducing their margin to the lowest possible point to aid in the large volume distribution of refined sugar in the summer fruit season, they have apparently endeavoured to scoop up the profits at that time. The following variation in margins will indicate this tendency :—

MARGINS BETWEEN DUTY PAID RAWS AND NET REFINED IN THE UNITED STATES.

	January	February	March	April	May	June	July	August
1928 ..	1·30 ..	1·41 ..	1·26 ..	1·49 ..	1·48 ..	1·69 ..	1·57 ..	1·44
1929 ..	1·20 ..	1·15 ..	1·08 ..	1·15 ..	1·26 ..	1·35 ..	1·28 ..	1·57

Ten Year Average	1880-1889 ..	1·10
,, ,, ,,	1890-1899 ..	0·85
,, ,, ,,	1900-1909 ..	0·87
,, ,, ,,	1910-1919 ..	1·03
Eight ,, ,,	1920-1928 ..	1·31

If high prices are any hindrance to increasing sales, it seems certain that the U.S. refiners by maintaining such a wide margin are acting in restraint of trade. During the War period, government regulations allowed only 1·30 as margin under the high costs of labour and materials of that time. The

price of refined sugar in the United States during August was higher than in Canada or Great Britain as is shown by the following :—

NET PRICE OF REFINED, AUGUST 1929.

United States ..	$5·39 per 100 lbs.
Great Britain	$5·28 per 100 lbs.
Canada	$5·18 per 100 lbs.

The importance of the United States refiners in the export market is also insufficient to warrant their selection as exclusive export toll refiners, since they exported only 64,122 long tons average from January to July 31st, 1929, as compared with 101,993 long tons of refined exported by British refiners. The latter are also good customers for Cuban raws and should be given an opportunity to share in any of this toll refining that may develop. For the present the refineries already existent in Cuba may be able to care for these orders.

The Cuban Sugar Export Corporation was formed in October, 1927, and has sold since that time 1,217,838 long tons average, at an average price of 2·41 f.o.b., mostly of the crops of 1926-27 and 1927-28. The following data as to its financial situation have been presented :—

FINANCIAL BALANCE TO AUGUST 31ST, 1929.

ASSETS.	
Cash on deposit in various Banks	$248,428·65
Co-operative Export Agency Cash	2,062·92
	$250,491·57
LIABILITIES.	
Capital stock 25,000 sh.	250,000·00
Excess income to August 31st	491·57
	$250,491·57

MOVEMENT OF CASH TO AUGUST 31ST, 1929.

INCOME.	
Cuban Government for organization, etc.	100,000·00
Cuban Government, July and August, 1929	11,666·66
Interest earned by deposits	66,630·84
Surplus from Sugar Sales liquidations	1,354·48
Total Income	$179,651·98
EXPENSES.	
Salaries (22 months)	125,175·45
Rents	7,445·00
International Conference........................	5,244·79
Col. Tarafa trip to Europe	9,400·00
Furniture and Fixtures	5,810·48
Other Expenses	26,084·69
	$179,160·41
Surplus Income.................................	491·57
	$179,651·98

The contributions from the Cuban Government in addition to the interest earned on deposits have practically taken care of all expenses. It is quite probable that upon reorganization into the Co-operative Export Agency the

capital funds will need to be increased. It is reported that the amount of sugar turned over to the Export Corporation to be handled as at September 1st, 1929, totalled around 400,000 long tons. This would indicate the following position of Cuba sugars as at August 31st, 1929.

CUBAN EXPORTS AND STOCKS AS AT AUGUST 31ST.

	1927-28		1928-29
Total production, Sp. long tons	4,041,856	..	5,156,410
For local consumption	150,000	..	150,000
Available for export	3,891,856	..	5,006,410
Shipped to United States	1,662,094	..	2,896,232
Shipped to other markets	843,484	..	931,530
Total Shipped	2,505,578	..	3,827,762
Stocks August 31st	1,386,278	..	1,178,648
Left over from previous crop	—	..	7,953
Total on hand	————	..	1,186,601
Reported as sold and unshipped, August 31st	—	..	786,601
To be sold by the new Co-operative Export Agency	—	..	400,000

This statement indicates that 92 per cent. of the exportable crop was sold during the first eight months of 1929, thus leaving only 8 per cent. or 400,000 tons to be handled by the new Co-operative Export Agency, during the remaining third of the year. Such a rush to sell has seldom been known and is a good example of the stampede occasionally produced when the crop is being sold by hundreds of holders. The imminent Tariff increase in the United States induced operators to buy great quantities of Cuban sugar for storage within the Tariff wall, and mistrust of the newly created C.E.A. determined many holders to liquidate rather than turn their sugars over. The range of prices as averaged at the six leading Cuban ports in warehouse is as follows:—

	1929 Jan.	Feb.	March	April	May	June	July	Aug.	Ave.	15,500 tons C.E.A. Sept.
Per 100 lbs. Cuban Port Warehouse	1·78	1·68	1·67	1·61	1·54	1·49	1·82	1·80	1·67	2·10

The average for eight months of promiscuous selling is 1·67 in spite of the rise in July and August. A more auspicious beginning for the C.E. Agency could hardly be imagined; the market has been taken from the buyers and is now a strong sellers' market as far as Cubas are concerned, with the buyers bidding up the price until acceptable to the single seller. With only about 100,000 tons per month to sell, there is no hurry, and a policy of waiting has been inaugurated which it is hoped may become permanent. With the prospects of a short crop in 1930 and strong sales control to distribute the selling over 12 months as compared to the frenzied liquidation of some 4,600,000 tons this year in eight months, there seems to be no reason why the Co-operative Export Agency should not achieve an outstanding success.

One point looming on the horizon for October is the European Conference of exporting nations in which Cuba has been taking a prominent part. Now that unified sales control has been secured in Cuba there is great danger that Cuba may enter into some unwise International combination and jeopardize her prospective strong position. A short study of the European situation should convince most sugar men that whatever problem it presents is susceptible of solution by the European sugar producing nations themselves. The mere fact that a producing country has a surplus for export does not indicate

that it is entitled to a hearing in an Export Conference, since its home consumption may be so low that if given proper attention it might be built up to absorb the bothersome excess. A glance at the following tables will be of interest.

CONDITIONS IN LEADING EUROPEAN EXPORTING COUNTRIES.

Country	Approximate Population.	Export Sugar Metric Tons	Annual Consumption in Pounds per Capita 1923-24	1924-25	1925-26	1926-27	1927-28	Ave. 5 yrs.
Belgium	7,874,000	43,000	48·3	54·9	54·2	53·8	58·2	53·7
Czecho	13,613,000	760,000	56·8	60·8	63·0	56·6	59·5	59·3
Germany	62,348,000	75,000	32·2	48·9	49·8	52·7	56·0	47·9
Hungary	8,368,000	72,000	13·2	22·5	24·5	27·3	29·7	23·4
Poland	29,160,000	250,000	15·8	21·6	22·2	25·3	28·0	22·6
Total	121,363,000	1,200,000	Ave. 30·7	42·2	43·1	44·8	47·9	41·7

CONDITIONS IN LEADING EUROPEAN SUGAR IMPORTING COUNTRIES.

Country	Approximate Population.	Sugar Imports Metric Tons	Annual Consumption in Pounds per Capita 1923-24	1924-25	1925-26	1926-27	1927-28	Ave. 5 yrs.
Austria	6,526,000	98,000	50·4	58·8	65·7	57·9	66·1	59·8
Denmark	3,434,000	96,000	106,2	109·5	118·6	107·1	113·9	111·0
Holland	7,416,000	100,000	65·7	63·0	63·2	64·3	67·4	64·7
Sweden	6,053,000	125,000	74·5	81·8	81·6	79·1	83·1	80·0
Switzerland	3,936,000	143,000	81·1	80·8	87·5	75·6	93·7	83·6
Total	27,365,000	562,000	71·3	74·4	78·3	73·9	80·1	75·4

In no case does the five-year average consumption rate in any exporting country exceed that of any importing country, while the general average for the importing countries is 33·7 lbs. greater than that of the five exporting countries. If the latter with their large population exceeding 120,000,000 should increase their average annual consumption at home by 22·1 lbs. to 70·0, the entire export surplus of 1,200,000 tons would be used at home and the consumption would still be less than that of the importing countries. Attention might be called to Jugo-slavia and Rumania having a combined population of some thirty millions and consuming only 17 lbs. per capita on the average. As a matter of fact, the principal subject of any such Conference should be *consumption*, which by proper development will take care of troublesome " export surpluses."

Just as the naval experts are searching for a yard stick to standardize the strength of their navies, so it seems to us do the sugar experts need some sugar consumption meter to gauge the qualifications of export countries to participate in international conferences. Cuba exporting five million tons of sugar has a consumption rate of 98·3 lbs. per capita, while Java, exporting 2,500,000 tons only has a rate of 22·4 lbs. per capita. Considering its present strong position, Cuba has no need to engage in any international agreement looking to the limitation of production or exports, or fixation of prices. She should hail such proposals with the querv " How is your sugar consumption to-day ? "

1929-30 FORMOSA SUGAR PRODUCTION.—The Department of Overseas Trade reports that the first official estimate of sugar production in Formosa for the year 1929-30 places the output of centrifugals (including plantation white) at 12,397,272 piculs (about 732,000 tons) and of brown sugars at 213,378 piculs (about 12,600 tons) making a total of 12,610,650 piculs or 744,600 tons. On the basis of these figures, production this season will show a decrease of 544,830 piculs, or about 32,000 tons, as compared with 1928-29, the diminished output being due to a reduction of about 18,600 acres in the area planted with cane.

A Sugar Machinery Contract.

A Case in the Edinburgh Law Courts.

An action was lately brought in the Court of Session, Edinburgh, by the Japaha Sugar Co., Muzafferpur, Behar, India, against the Harvey Engineering Co., Ltd., of Glasgow, for £23,627 as damages in respect of alleged breach of contract over the supply of certain sugar plant and machinery for their factory in India. The particular complaint was that some 1930 solid drawn brass evaporator tubes supplied in pursuance of this contract were defective, unfit for the purpose for which they were required, and unmerchantable.

The judge in the course of summing up the evidence in his judgment[1] said that the factory was erected in 1906 and the whole of the machinery and plant then installed was supplied by the defendants, the Harvey Engineering Co., Ltd. This plant worked efficiently and in particular there was no trouble whatever with the brass tubes of the triple effect. In 1924 the plaintiffs desired to increase the capacity of their factory and therefore decided to add a pre-evaporator to the triple and also to enlarge the vessels of the latter, particularly the calandrias. The necessary plant was ordered from and supplied by the defendants and it included 1930 solid drawn brass tubes, which like the first lot were purchased by the defendants from other manufacturers. The new evaporating plant was used during the whole of the 1925-26 season in Behar, and no difficulty of any kind was experienced. In January, 1927, a few days after the 1926-27 crushing season began, the brass tubes, first in the calandria of the pre-evaporator and subsequently in the calandrias of the vessels of the triple effect, began to crack, and this trouble continued until May 16th when manufacturing ceased. In all 71 tubes cracked and it was found that in addition a number were on the point of giving way.

According to the plaintiffs' evidence this cracking of the tubes resulted in a large part of the cane crop being altogether wasted, an unusually small proportion of sugar being extracted. They took the view that there was something seriously defective with the whole consignment of brass tubes, and accordingly they had them all removed and ordered new tubes from the defendants. These tubes were installed in 1927 and no trouble had been experienced since that date.

It was not disputed that the material of which the tubes were manufactured was of excellent quality. The principal question argued before the Court was whether the breakdown of the tubes was due to a defect in the process of manufacture, or due to the treatment which they received after they were delivered to the plaintiffs. The circumstance that the breakdown did not take place immediately after delivery, but that the tubes did their work for a whole year without anything untoward happening was in defendants' favour.

After reviewing the evidence in detail, the Judge said that he was of opinion that the plaintiffs had failed to prove that the "season cracking" was caused by internal stresses in the metal due to some defect in the process of manufacture and present at the date of delivery. He reached the conclusion that what had occurred was not inconsistent with the defendants' theory that "season cracking" only took place in the presence of certain chemical reagents which attacked the junction between the grains of the metal, and that in this particular case was the presence in excessive quantities of sulphur dioxide in the juice. He therefore decided that plaintiffs had failed to prove any case of breach of contract on the defendants' part, and he gave judgment accordingly in favour of the defendants, the Harvey Engineering Co., Ltd., with costs.

[1] For this account we are indebted to a report of the judgment appearing in the *Glasgow Herald*.

A Few Notes on Alcohol.

By P. H. PARR

Since alcohol is very easily obtained by the fermentation of uncrystallizable sugars, its production, of one type or another, has practically always been closely associated with sugar factories, and in many places by far the best method of utilizing the molasses is to ferment it to alcohol.

Alcohol production is, in fact, so important that there is quite a number of factories—all small, of course, in comparison with big sugar centrals—where sugar cane is crushed solely for alcohol, and the whole of the extracted juice is sent directly to the fermenting vats.

The sugars can be fermented variously according to the qualities desired for the resultant alcohol, to use the word in its vulgar signification: and the production of special potable spirits such as, say, Jamaica or Demerara Rums, South American Aguardiente, etc., and of high strength "industrial" or "power" alcohol, require quite different methods.

There are numerous alcohols, from a chemical point of view, but in general the term is used to mean "ethyl alcohol" (C_2H_5OH), and this is the principal constituent of potable spirits, and usually the only desirable one for technical alcohol.

For potable spirits, such as rum, the special flavour depends entirely on the presence of very small quantities of many ethers and esters, which in turn depend on the particular ferments which are active, and also on the conditions of the fermentation and distillation. The production of the high-flavoured Jamaica rums appears to depend on bacteriological action as well as on various yeasts, and the fermentation takes up to 14 days. The ferments have by no means been generally identified, and they appear to be not only adventitious, but frequently confined to comparatively small local areas, so that rum made at one factory may be quite different from that made at another factory only a few miles away (even with factories under the same ownership, and with every endeavour to improve the quality from the poorer plant).

Under modern conditions, however, the most usual requirement is high-strength alcohol for power purposes, and for this the desiderata are a maximum quantity of ethyl alcohol and a minimum of other alcohols, ethers, etc. There are, of course, now a number of technical distilleries specially constructed for making butyl alcohol and other solvents, but these productions are quite outside those of the sugar factories.

In order to obtain the maximum amount of ethyl alcohol from a molasses or other wash, the wash itself must be sterilized by heating to about boiling point, and cooling; and the yeast used for fermenting must be propagated in sterilized liquor from a pure culture.

Under suitable conditions, and with sterilized washes and pure yeasts, the fermentation to ethyl alcohol only requires about two or three days, instead of the two weeks for the high-flavoured Jamaica rums.

With reference to the yield of alcohol, the figures given by J. MAGNE[1] may be noted :—

"Best from pure sugar, 7·31 gallons absolute alcohol per 100 lb. sugar.
Best from rich and pure molasses, 6·94 gallons or 95 per cent.
From yeast naturally in material 2·9-4·0 gallons or 40-60 per cent.
From compressed yeast, 3·6-5·5 gallons or 50-75 per cent.
From compressed yeast with antiseptics, 5·4-6·2 gallons or 70-85 per cent.
From pure culture yeast, 6·2-6·9 gallons or 85-95 per cent."

[1] *I.S.J.*, September, 1919.

From these figures it is very evident that where the maximum production of ethyl alcohol is required, it is necessary to use pure culture yeast, and this in sterilized wash.

In many cases a sugar factory can use with advantage a large proportion of the alcohol it can produce from its molasses, for motor cars (or automobiles as many still call them), tractors, etc., and in some cases, where auxiliary fuel is necessary, it is better to use it as alcohol rather than to attempt to burn the molasses direct, a proceeding which offers considerable difficulty in any ordinary furnace.

Some motor vehicles will run on alcohol without alteration, and some require a modification to the compression. Tractors, trucks and factory "stand-by" or "week-end" engines are readily obtained to run on alcohol.

In cases where a lighter spirit is desirable for power purposes, the alcohol may be mixed either with petrol (American "gas" or "gasoline"), or with ether, which is obtained by dehydrating[1] a portion of the alcohol produced, in a special plant, but this latter plant is rather expensive, and is not suitable for working except on a somewhat large scale.

When making alcohol from molasses, the latter is usually diluted to about 1·06 s.g., and the fermented wash contains from 4 to 8 per cent. alcohol in ordinary cases. In special cases, and when cane juice is fermented directly, the alcohol content may be considerably greater.

The alcohol is of course separated from the wash by distillation, and the particular type of still used depends on the spirit quality required.

For rums and other potable spirits, the pot still is generally used, as the ethers, etc., are to remain in the product. A pot still with a single retort will give spirit at roughly British "Proof," or about 57 per cent. alcohol by volume. A similar still with a second retort, as used in Jamaica, or a small tubular rectifier, will produce spirit at about 40 O.P. (British over Proof) or say 80 per cent. alcohol by volume.

For power purposes, however, a continuous still may be regarded as a necessity, and in general, what is called a "two-column" still is the most suitable. This consists essentially of a "boiling" column in which the alcohol is completely boiled out of the wash, and a "rectifying" column in which the alcohol-water vapour from the boiling column is deprived of its water content so that a high-strength alcohol results.

In this connexion it may be noted that it is not possible to obtain by direct distillation a higher alcohol strength than about 97 per cent. by volume, since, at atmospheric pressure, this mixture distils over unchanged. This 97 per cent. alcohol is quite satisfactory for nearly all purposes, but in some cases it is required to remove the final 3 per cent. of water, and this can only be done by chemical absorbtion of the water by a dehydrating agent such as "quick lime" (CaO) in a special still, and, for commercial results, the plant should be on a fairly large scale.

Column stills are arranged so that the fusel oils, ethers, etc., are separated out, and the alcohol obtained is practically pure and suitable for all ordinary commercial purposes. For medicinal purposes (B.P. purity) and technical work where chemically pure alcohol is required, a further rectification may be necessary, or a still with more than two columns, but for all ordinary sugar factory purposes, the two-column still is completely satisfactory, while it is comparatively low in cost and is easy to operate.

Column stills are arranged to separate the fusel oils and ethers from the alcohol, but where the alcohol is to be used by the producing factory for engines

1 In this instance is meant a chemical dehydration of the molecule from C_2H_5OH to $C_2H_5OC_2H_5$.

or automobiles, the ethers are rather an advantage than otherwise, and may well be returned to the alcohol. The fusel oils are always better away, and it depends on the market available as to whether they can be sold to advantage, or can only be thrown away.

Under present conditions, the utilization of molasses for alcohol production appears to be the best method of disposal. The alcohol contains only carbon, hydrogen and oxygen, and—except for a certain amount of nitrogen taken by the ferments—all of the manurial value of the molasses (chiefly potash) remains uninjured in the spent wash.

Unfortunately, the spent wash is an offensive kind of liquor, and readily undergoes fermentations of various types, with most objectionable results. In general, where there is a suitable river close at hand, the spent wash is run into it, and at other places it is run on to waste ground. It is usually impracticable to use it directly on the cane fields.

There are various ways of dealing with the spent wash so as to reclaim the manurial portion in a manageable form, but it is not purposed to touch on this side of the problem in these few notes.

When dealing with alcohol, the strength is practically always determined by a floating hydrometer (areometer, etc.) or by floating "bubbles" of particular densities, and there are many scales in use, though of course the readings all depend on the density of the alcohol-water mixture. The relations between density and alcohol proportion by volume and by weight have been very exactly determined, and the various areometer scales are compared through the density values.

Probably the most rational alcohol scale is the Gay-Lussac, or Tralles, which is adjusted so that the scale degrees represent directly the percentage of alcohol by volume. This scale is standard in France, Germany and other countries, and its use appears to be extending.

In Britain the legal standard refers to "fiscal proof spirit," for which the specific gravity is $\frac{12}{13}$, and the areometer used is known as Sikes, the readings having to be referred to a standard table for the proof degrees.

The U.S.A. scale is a "proof" scale, but is more rational than the British, and the U.S.A. degrees are half the Gay-Lussac ones, so that 50 per cent. alcohol by volume = 50° Gay-Lussac = 100° (proof) U.S.A.

Another scale which is generally used in most parts of South America is the Cartier, and unfortunately there does not appear to be any really definite basis for this scale—although it is so extensively used—and the readings of actual instruments vary quite considerably. The relation of the Cartier to the Gay-Lussac scale may be compared with that of the Baumé to the Brix scale : in both cases the latter is more definite and rational, but the former is firmly established in many places, and is not likely to be displaced for many years to come.

In view of the facts that the Cartier areometer is still in general use in many parts of South America, and that the Cartier-Density and Cartier-Gay-Lussac tables given in various books differ very considerably, the writer has made a number of inquiries with the object of obtaining the most accurate data available.

It appears that there has never been any really exact technical definition of the Cartier scale, and there always have been, and still are, very appreciable differences between the instruments constructed by various makers.

The British National Physical Laboratory advise that their only fundamental data are that the Cartier scale was to read 10° in distilled water at 12·5° C., and that the divisions of the scale were to be equally spaced along a

stem of uniform cross section, with the numbering increasing as the density decreases.

This only fixes one point on the scale, and a second (unspecified) point was obtained by testing several instruments by reputable makers and averaging. As a result, the N.P.L. give a Cartier-s.g. table which corresponds almost exactly to :—

$$\text{s.g. at } \frac{60^\circ \text{ F.}}{60^\circ \text{ F.}} = \frac{132{\cdot}59}{122{\cdot}56 + \text{Deg. Car.}} \qquad (1)$$

or say :—

$$\text{s.g. at } \frac{60^\circ \text{ F.}}{60^\circ \text{ F.}} = \frac{132{\cdot}6}{122{\cdot}6 + \text{Deg. Car.}} \qquad (1a)$$

which gives British proof spirit as 21·6° Car. and absolute alcohol as 44·5°Car.

The most interesting information, however, comes from a leading French maker of precision measuring instruments,[1] from which it appears that Cartier was a working goldsmith employed to make the first Baumé areometers in 1763, and that he used the idea for his own purposes, introducing the Cartier instrument in 1771 (regarding which Baumé complained bitterly as to the theft of his idea).

The graduation appears to have been 10° Car. in water, and 0° Car. in a solution of 90 per cent. water and 10 per cent. *sel marine* (presumably "sea salt"); and the scale was extended upwards for lighter liquids.

In 1824 the Gay-Lussac areometer, reading directly the alcohol percentage by volume at 15°C., was adopted by the French Government, and a Cartier-Gay-Lussac table was given, according to which water indicated 10·03 Car. and alcohol 44·19° Car.

Another important table was given in the *Barème décimal de Bourquin* (1843), giving the Cartier-Gay-Lussac correspondence from 17° to 37° Car., from which the writer finds the s.g.-Cartier relation at 60°F./60°F. to be given very closely by :—

$$\frac{129{\cdot}3}{119{\cdot}3 + \text{Deg. Car.}} \qquad (2)$$

This gives British proof spirit as 21·3° Car. and absolute alcohol as 43·6° Car.[2]

Apparently the most accurate data refer to two points determined (as averages) by Gay-Lussac, these being 10° Car. = 0·999425 s.g., and 28° Car. = 0·879730 s.g. both at 15°C./4°C., from which :—

$$\text{s.g. at } \frac{15^\circ \text{ C.}}{4^\circ \text{ C.}} = \frac{132{\cdot}219}{122{\cdot}295 + \text{Deg. Car.}} \qquad (3)$$

or :—

$$\text{s.g. at } \frac{15^\circ \text{ C.}}{15^\circ \text{ C.}} = \frac{132{\cdot}334}{122{\cdot}295 + \text{Deg. Car.}} \qquad (3a)$$

Various published tables give alcohol as anything from 43° to 46½° Car., but they generally have no authentic basis.

In view of the variations, and the lack of any legal definition, the writer suggests that, for all ordinary purposes, the Cartier scale may be taken as :—

$$\text{s.g. at } \frac{60^\circ \text{ F.}}{60^\circ \text{ F.}} = \frac{132{\cdot}3}{122{\cdot}3 + \text{Deg. Car.}} \qquad (4)$$

which gives water = 10·0° Car.; American proof spirit = 19·3° Car.; British

1 Dujardin Frères, 24, Rue Pavée, Paris, Iv.

2 Dujardin Frères state that they actually base their instruments on this table, but a study of their scales shows that they rather base them on the table mentioned in the previous paragraph, with 100° G.L. = 44·19° Cartier.

proof spirit = 21·5° Car.; 97° Gay-Lussac (the practical limit from direct distillation) = 41·5° Car.; and absolute alcohol = 44·4° Car.

It should be noted that the variation of density with temperature for alcohol-water mixtures is considerable, so that, unless an areometer is used at the exact temperature for which it is graduated, the reading may be considerably in error unless the appropriate correction is applied. The writer has heard of alcohol at 43° Car. being obtained from an ordinary two-column still, but this is practically impossible, and of course the reading can readily be accounted for by the fact that, in the Tropics, the alcohol leaves the still at a much higher temperature than 60°F. (usually nearer 100°F.), and so has an appreciably lower density than that at the normal temperature for which most instruments are graduated.

The following table will be found to be convenient, and to cover all usual sugar factory requirements. The first four columns are from British Standard tables (which may differ slightly from Continental and American ones, since fiscal tables are not always in concordance either with each other, or with the latest scientific data), and the last column has been calculated from formula (4) above. The accuracy is greater than the usual pocket book tables.

Regarding the second column of the table, this gives the British fiscal per cent. alcohol by volume, for s.g. at 60°F./60°F.; Gay-Lussac is at 15°C./15°C.; and Tralles at 15·5°C./15·5°C. The differences are negligible for ordinary practical purposes, though they may have to be considered for technical or fiscal requirements.

Owing to the differences between actual Cartier areometers, it is not advisable to guarantee definite high-alcohol strengths on this scale, but only on an s.g. or G.L. basis at a specified temperature.

TABLE FOR ETHYL ALCOHOL.

Specific Gravity at 60 F./60 F.	Per Cent. Alcohol by volume. Gay-Lussac. Tralles.	Per Cent. Alcohol by weight.	Per Cent. British Proof Spirit.	Degrees Cartier.
0·79359	100·0	100·0	175·3	44·4
0·794	99·9	99·9	175·2	44·3
0·795	99·7	99·5	174·9	44·1
0·796	99·5	99·2	174·5	43·9
0·797	99·3	98·9	174·2	43·7
0·798	99·1	98·6	173·8	43·5
0·799	98·9	98·2	173·4	43·3
0·800	98·7	97·9	173·1	43·1
0·801	98·5	97·6	172·7	42·9
0·802	98·3	97·2	172·3	42·7
0·803	98·1	96·9	171·9	42·5
0·804	97·8	96·6	171·6	42·3
0·805	97·6	96·2	171·2	42·0
0·806	97·4	95·9	170·8	41·8
0·807	97·2	95·5	170·4	41·6
*0·8075	97·0	95·4	170·2	41·5
0·808	96·9	95·2	170·0	41·4
0·809	96·7	94·8	169·5	41·2
0·810	96·4	94·5	169·1	41·0
0·811	96·2	94·1	168·7	40·8
0·812	96·0	93·8	168·3	40·6
0·813	95·7	93·4	167·9	40·4

* Practical limit of direct distillation.

Specific Gravity at 60°F./60°F.	Per Cent. Alcohol by volume. Gay-Lussac. Tralles.	Per Cent. Alcohol by weight.	Per Cent. British Proof Spirit.	Degrees Cartier.
0·814	95·5	93·1	167·4	40·2
0·815	95·2	92·7	167·0	40·0
0·816	95·0	92·4	166·5	39·8
0·817	94·7	92·0	166·1	39·6
0·818	94·4	91·6	165·6	39·4
0·819	94·2	91·3	165·1	39·2
0·820	93·9	90·9	164·7	39·0
0·822	93·4	90·2	163·7	38·6
0·824	92·8	89·4	162·7	38·3
0·826	92·3	88·6	161·7	37·9
0·828	91·7	87·9	160·7	37·5
0·830	91·1	87·1	159·7	37·1
0·832	90·5	86·3	158·7	36·7
0·834	89·9	85·6	157·6	36·3
0·836	89·3	84·8	156·6	36·0
0·838	88·7	84·0	155·5	35·6
0·840	88·1	83·2	154·4	35·2
0·842	87·4	82·4	153·2	34·8
0·844	86·8	81·6	152·1	34·5
0·846	86·1	80·8	151·0	34·1
0·848	85·5	80·0	149·8	33·7
0·850	84·8	79·2	148·6	33·3
0·855	83·1	77·1	145·6	32·4
0·860	81·3	75·0	142·5	31·5
0·865	79·5	73·0	139·4	30·6
0·870	77·7	70·9	136·2	29·8
0·875	75·8	68·8	132·9	28·9
0·880	73·9	66·7	129·5	28·0
0·885	71·9	64·5	126·1	27·2
0·890	69·9	62·4	122·6	26·4
0·895	67·9	60·2	119·0	25·5
0·900	65·8	58·1	115·3	24·7
0·905	63·7	55·9	111·6	23·9
0·910	61·5	53·6	107·7	23·1
0·915	59·3	51·4	103·8	22·3
*0·91976	57·1	49·3	100·0	21·5
0·920	57·0	49·2	99·8	21·5
0·925	54·6	46·9	95·6	20·7
0·930	52·2	44·5	91·4	20·0
†0·93429	50·0	42·5	87·5	19·3
0·935	49·6	42·1	86·9	19·2
0·940	46·9	39·6	82·2	18·4
0·945	44·1	37·1	77·2	17·7
0·950	41·1	34·4	72·0	17·0
0·955	37·9	31·5	66·3	16·2
0·960	34·3	28·4	60·0	15·5
0·965	30·3	25·0	53·0	14·8
0·970	25·8	21·1	45·1	14·1
0·975	21·0	17·1	36·6	13·4
0·980	16·0	13·0	28·0	12·7
0·985	11·4	9·2	19·9	12·0
0·990	7·2	5·8	12·5	11·3
0·995	3·4	2·7	6·0	10·7
1·000	0·0	0·0	0·0	10·0

* British Fiscal Proof. † U.S.A. Fiscal Proof.

The European Beet Sugar Crop of 1928-29.

By H. C. PRINSEN GEERLIGS, Ph.D.

The 1928-29 figures for the European area under beets, expressed in hectares, and for the sugar extracted from them, expressed in metric tons raw value, are tabulated here with those for 1927-28 as a comparison.

	1927-28		1928-29	
	Hectares	Metric Tons	Hectares	Metric Tons
Germany	406,739	1,664,766	429,099	1,846,612
France	230,425	863,205	237,800	904,371
Czecho-Slovakia	281,321	1,239,155	250,475	1,038,033
Austria	23,529	110,004	27,677	107,337
Hungary	62,353	186,701	65,503	219,232
Belgium	71,380	273,113	63,217	279,290
Netherlands	69,002	259,964	65,255	319,937
Denmark	39,700	142,800	41,200	168,421
Sweden	40,555	145,335	42,621	160,860
Poland	193,032	566,961	230,385	756,832
Italy	92,240	284,276	112,849	367,334
Spain	65,000	259,964	75,000	238,094
Great Britain	93,167	208,410	71,200	212,380
Ireland	7,080	20,500	6,100	20,000
Danzig	6,099	27,580	7,773	30,000
Yugo-Slavia	55,400	83,600	61,500	127,950
Rumania	72,500	139,522	52,000	122,400
Bulgaria	19,400	42,368	17,000	29,870
Switzerland	1,600	6,550	1,600	7,000
Finland	2,750	5,959	2,800	4,000
Latvia	1,000	2,000	2,000	2,000
Turkey	3,500	6,000	3,500	4,000
Russia	640,000	1,501,986	759,000	1,380,000
Total	2,477,772	8,040,719	2,625,554	8,345,953

It will be seen from these data that the sugar industry of Europe has again expanded, but at the same time the total increase by 147,782 hectares is seen to be only slightly greater than the extension of sowings in the Russian Soviet Union, some 119,000 hectares. The surface planted in the main area of Europe is therefore only very little larger than in 1927-28. The total increase in sowings is 6 per cent. and in Europe, omitting Russia, only 1·3 per cent.

Germany, Austria, Poland, Italy, Spain, Russia and Yugo-Slavia showed an advance in sowings; Czecho-Slovakia, Belgium, the Netherlands, Great Britain, and Rumania a decrease, while the differences in the sowings of the other producing countries were trifling. The sugar production went up by 306,000 tons or 3·8 per cent. for all Europe, but by 428,000 tons or 6·5 per cent. for the European countries, omitting Russia. This shows that the sugar production to the hectare in Russia fell off as compared with 1927-28, while, on the whole, in Europe proper the sugar extraction per unit of area was still better than in the already favourable year of 1927-28. In 1927-28 the output was 3·24 tons of raw sugar to the hectare in all Europe and 3·55 for Europe outside Russia, and in 1928-29 the figures were 3·18 and 3·73 respectively.

The total European sugar output has at last attained once more to the highest level reached before the war, when it was 8,341,063 tons in 1912-13; but the distribution over the different countries of production has undergone considerable changes.

During the statistical year 1928-29 Europe consumed the equivalent of 10,125,000 tons of sugar, raw value, against 9,600,000 tons in 1927-28, and 8,925,000 tons in 1926-27. It exported about 600,000 tons of sugar, raw value, to the North coast of Africa, British India, China, Asia Minor, Persia, Afghanistan, Mongolia and to Russian Asia. The deficit, amounting to 2,380,000 tons, raw value, was covered by importations from the British Colonies and Dominions, from the French and Portugese Colonies, from Cuba, San Domingo, Peru, Brazil. Java, Surinam, etc.

The initial stocks, which were calculated at 682,000 tons raw value on September 1st, 1928, increased slightly and rose to 903,000 tons on August 31st, 1929.

The details for the various countries follow here :—

GERMANY.—In the year 1928-29 248 sugar factories were active, against 250 in 1927-28. The sowings extended by 22,360 hectares or 5·5 per cent., and the sugar output by 183,000 tons or 11.0 per cent., which shows an increase of sugar production to the hectare from 4·09 to 4·3. i.e., 0·21 tons or 5 per cent. The beet crop amounted to 11,492,500 tons against 10,657,000 tons in 1927-28, giving a beet production per hectare of 27·79 tons and a sugar extraction on 100 parts of roots of 16·10, against 26·23 tons of beets to the hectare and 15·72 per cent. extraction in 1927-28. On the whole the agricultural and technical results of the crop were satisfactory. Besides the sugar produced from the home grown beets, about 14,000 tons of sugar were extracted from 88,000 tons of imported roots.

Germany imported 75,000 tons of sugar from Czecho-Slovakia, Danzig, and Java, and exported 195,200 tons to various destinations. The home consumption attained the figure of 1,728,000 tons raw value, against 1,656,900 tons in 1927-28. The initial stocks of 226,773 tons during the course of the year increased to 255,000 tons by 31st August, 1929.

FRANCE.—France is a fortunate country; it gradually extends its planted area and its sugar production, not only to the hectare but also in total; and manages to keep just within the consumption requirements. It has therefore no need to try and seek markets for its surplus, and can keep for itself all the benefit of the high customs duties. Since France imported considerable amounts of beets from Belgium and the Netherlands, we cannot calculate the sugar produced to the hectare planted, as there is no direct relation between them. The number of active factories increased from 108 in 1928 to 110 last season. In 1928-29 France consumed 918,010 tons of white sugar, or slightly more than its production. It exported refined sugar to its Dominions and Protectorates on the North coast of Africa and imported sugar from the French Antilles and Réunion. Further, some sugar was imported from Java, Cuba, Germany, Poland and a few other sources. The total importation is put down at 520,000 tons and the exports at 220,000 tons.

The initial stocks on September 1st, 1928 were 110,000 tons, and had increased to 203,000 tons by August 31st, 1929.

CZECHO-SLOVAKIA.—A total of 151 sugar factories worked in 1928-29, against 152 in the previous year. Of these 93 were situated in Bohemia, 44 in Moravia, three in Silesia, and 11 in Slovakia. The area planted with beets underwent a notable decrease, especially in Bohemia and in Moravia, whereas it increased somewhat in Slovakia. The low price of sugar at the time when the beets were contracted for discouraged farmers from participating so extensively as in former years.

The European Beet Sugar Crop of 1928-29.

In 1928-29 5,994,499 tons of beets were worked up, against 7,476,323 tons in 1927-28. We calculate from these data :—

	1927-28		1928-29
Tons of beets per hectare	26·58	..	23·93
Tons of sugar per hectare	4·41	..	4·14
Extraction of sugar on 100 beet	16·57	..	17·30

Czecho-Slovakia did not import any beetroots or sugar, consumed 400,000 tons raw value, and exported 595,707 tons of sugar chiefly white, equivalent to 673,613 tons raw value.

Owing to fiscal measures taken in Great Britian and, later on, also in Germany, Austria and Italy, the sugar exportation of Czecho-Slovakia was greatly handicapped ; but, in spite of all, the manufacturers were successful in disposing of their surplus, so that the initial stock of 109,653 tons on September 1st, 1928, dropped to 91,500 tons on August 31st, 1929.

The destination of the exports calculated as raws was as follows :—

Destination	Tons, 1927-28		Tons, 1928-29
Hamburg (transit)	265,343	..	203,111
Italy (transit)	139,333	..	119,547
United Kingdom	113,284	..	60,428
Austria	80,001	..	103,399
Switzerland	90,659	..	90,205
Germany	40,198	..	21,578
Other European Countries	31,451	..	8,445
Asia	10,172		
Africa	4,707	..	66,900
America (Argentina)	1,814		
	776,962	..	673,613

AUSTRIA.—The planted area and the sugar production in Austria were much the same as in 1927-28, so that the endeavours of that country to satisfy its own wants have not made any marked headway. Since the consumption amounted to 212,500 tons and the production was only 107,337 tons, about 105,000 tons had to be imported from Hungary and Czecho-Slovakia. The stocks both at the outset and at the end of the statistical years were insignificant and amounted to a few thousand tons only.

HUNGARY.—In Hungary also, the beet plantings and the sugar production did not differ greatly from those in 1927-28. The country produced 219,232 tons, consumed 120,000 tons, and had therefore about 100,000 tons to spare, which found their way to Austria, the Balkan States, and to some extent to British India. In this country, likewise, the initial and final stocks were very small and of no account.

BELGIUM.—The Belgian sowings have been curtailed since 1927-28 by 8000 hectares or 11 per cent., and although rather considerable quantities of beets have been exported to France, the sugar production has gone up by 6000 tons. We must, however, bear in mind that rather large consignments of beets from the Netherlands helped to swell the Belgian sugar production. Imports of beetroots may be put down at 175,000 tons and exports at 150,000.

Belgium imported 75,000 tons of sugar, chiefly raw, and exported, after refining, some 108,000 tons of white sugar to various destinations. The consumption is calculated as 210,000 tons raw value, thus leaving about 70,000 tons of the domestic production available for export.

The year 1928-29 started with an initial stock of 46,000 tons and ended with one of 69,000 tons, so that here the same factor is apparent as in the neighbouring countries, viz., a difficulty in disposing of the sugar produced.

NETHERLANDS.—In the Netherlands 65,255 hectares were sown with beets or about 4000 less than in 1928, and from the beet crop a quantity of 390,282 tons of roots has been exported to Belgium and France in fairly even quantities. The production of sugar from the beets worked up in the country does not therefore stand in any proportionate relation to the acreage actually planted.

According to official statistics 1,917,663 tons of beets have been worked up, from which 111,945 tons of raw and 184,882 tons of white sugar have been extracted, or on the raw sugar basis 319,937 tons, against 259,964 tons in the previous year. The figure for 1928-29 is equivalent to an extraction of 16·67 per cent. of sugar on 100 of beets.

In addition, the Netherlands imported 12,700 tons of white and 200,000 tons of raw sugar, from which latter material, also from raw domestic beet-sugar, 227,500 tons of white sugar and 12,400 tons of soft yellow sugar were produced in refineries.

The country consumed 290,000 tons of sugar raw value, inclusive of the sugar exported in condensed milk, jams, etc., and exported 125,700 tons of whites and 18,700 tons of raws. The destination of this last sugar was Great Britain and Ireland, Scandinavia, Switzerland, Irak and a few other countries.

The initial stock of 40,000 tons raw value on September 1st, 1928, rose to 98,000 tons on August 31st, 1929, showing again the difficulties encountered in Holland in disposing of the sugar production.

DENMARK.—The area devoted to beet cultivation in Denmark was about the same as in 1927-28, but as a consequence of favourable weather the sugar production was much better. In 1927-28 3·60 tons of sugar were produced to the hectare and in 1928-29 4·09 or 14 per cent. better.

The Danish sugar consumption of 210,000 tons requires an importation of 40,000 tons, which is supplied by Poland, Great Britain, the Netherlands, etc.

SWEDEN.—Sweden's sugar production in 1928-29 was about on the same level as that in 1927-28, the sugar production to the hectare being 3·58 and 3·78 tons respectively. Consumption being about 210,000 tons, some 50,000 tons have to be imported from the same countries as in the case of Denmark. Stocks both on August 31st, 1929, and September 1st, 1928, were negligible.

POLAND.—Notwithstanding the various trials to form international conventions for the stabilization of the sugar production, in which the Polish sugar manufacturers took part, the sowings in their country were extended by 37,000 hectares or by about 20 per cent. The sugar production went up by 190,000 tons or 33 per cent., which shows that the agricultural and technical results left nothing to be desired. The sugar yield of 2·95 tons to the hectare in 1927-28 rose to 3·29 in the year under consideration.

Consumption amounted to 403,000 tons or slightly more than in 1927-28, when it was 390,000 tons. The country exported 313,214 tons to Great Britain, Netherlands, Scandinavia and France.

The stocks on September 1st, 1928, of 40,000 tons rose to 81,000 tons on August 31st, 1929, showing that the exportation had not been as facile as in former years.

ITALY.—Once more Italy has extended her sowings and increased her sugar production so that she has almost reached the goal of her ambition—a position of independence from foreign sugar supplies. Year after year she

has tried to produce all the sugar needed in the country, and in 1928-29 a production of 367,334 tons raw value stood against a consumption of 400,000 tons. The small amount still lacking was imported from Czecho-Slovakia.

SPAIN.—In Spain sowings have increased, though not yet to the extent of 1926-27 and earlier years. The production amounts to 238,000 tons, or more than in 1927-28, but still not sufficient to meet the demand, which is estimated at 285,000 tons. The balance has to be imported from Cuba, with which island Spain has concluded a commercial treaty, allowing Cuban sugar entry at the same rate of duty as is equivalent to the excise on the home product. Other countries have to pay an additional duty on importation.

GREAT BRITAIN.—The area sown in 1928 was some 21,000 hectares (47,000 acres) less than in the year before, as a consequence of disappointments with the 1927-28 crop. The yield per hectare was somewhat higher than in 1928, being a trifle below 8 tons to the acre ; the average sugar content, on the other hand, was 1·2 per cent. higher than in 1927-28.

The sugar production amounted to 197,388 metric tons of white sugar, or more than in 1927-28, in spite of the greatly reduced sowings. Computed on the raw sugar basis we find a crop of 212,380 tons. The number of factories increased by one, from 19 to 20, but new ventures were entered upon by a number of existing sugar factories, which purchased foreign raws and refined them in their sugar-houses during the off-season as a result of the new duties levied on refined sugar in April, 1928. On the whole, the year proved successful for the British beet sugar industry and also for the farmers, who were induced to contract for yet more land to be grown with beets in 1929-30.

The sugar production of Ireland has neither increased nor decreased since last year ; we have assumed the figure of 20,000 tons raw value and arrive at the total amount of sugar produced in the British Isles as 232,800 tons raw value.

Against that amount Great Britain imported the following quantities of sugar.

COUNTRY OF ORIGIN	WHITE SUGAR Tons	RAW SUGAR Tons
Germany	899	35,364
Czecho-Slovakia	34,872	23,279
Netherlands	21,350	—
Belgium	1,387	—
Poland	507	79,265
United States	11,000	—
Canada	41	—
Java	—	131,391
Cuba	—	747,985
San Domingo	—	189,589
Peru	—	123,443
Brazil	—	15,736
Union of South Africa	—	95,736
Mauritius	—	243,316
Australia	—	191,063
British West India	—	106,017
Other Countries	212	61,323
Total	70,268	2,043,507

Total raw value = 2,121,582 tons.

A great deal of that sugar has been re-exported after having passed through refineries. These exportations were destined for the Irish Free

State, for a few continental countries, for British India and even for China. The total amount of the exportations was 172,210 tons.

The quantity of sugar consumed is calculated at 2,057,261 tons of imported sugar and 200,000 tons of domestic, or altogether 2,250,000 tons. The initial stocks on September 1st, 1928, of 172,537 tons decreased to a final stock of 101,443 tons on August 31st, 1929.

RUSSIA.—It is still very difficult to obtain reliable information about the Russian sugar crop, since some statistics refer to the factories of the "Saccharotrust" only and others to all factories, the leased ones included. Our latest information speaks of 1,225,000 long tons of sand sugar, which we have converted into 1,380,000 metric tons raw value. Other figures go as far as 1,440,000 tons, but we have preferred to assume the lower one.

Besides that quantity a small amount of sugar has been imported and, on the other hand, sugar has been exported over the eastern border to Persia, Afghanistan and Mongolia. Consumption is still very low in the Soviet Republic and will not increase to any considerable extent, if the home production remains so low as it is. But since the Russian sugar production and consumption do not affect the position of the world's market we need not dwell further on this point.

OTHER COUNTRIES.—Under this denomination we find Danzig, Yugo-Slavia, Rumania, Bulgaria, Switzerland, Finland, Latvia and Turkey with a total production of 327,220 tons of sugar, originating from 148,173 hectares. In 1927-28 these figures were 318,500 and 162,249 respectively, thus showing only small differences.

Their consumption, together with that of the non-producing countries Norway, Portugal, Greece and the Russian Border States, is estimated at 920,000 tons, against 975,000 tons in 1927-28.

If we take the continent as a unit, we see that it produced in all 8,173,000 tons and consumed 7,825,000 tons, so that it could spare some sugar for exportation overseas. Great Britain and Ireland, on the contrary, required 1,955,000 tons over their production, which amount was, as we pointed out above, only partially supplied by the Continental countries. Since the latter exported also to non-European destinations, the gaps had to be filled there also by importations from French and Portuguese colonies, from Cuba, Java, San Domingo, Peru, Surinam, etc.

SUGAR IN MOZAMBIQUE.—The Mozambique sugar production for the current season is estimated at 51,000 tons, 40,000 being from Sena estates at Luabo and Mopea, 10,000 from Incomati, and 1000 tons from Mutamba.

BEET EFFLUENT TREATMENT.—H. Bach, beet factory engineer, proposes[1] that beet factory waste-water be preliminarily subsided in settling basins, then discharged into the river, which is aerated at a suitable point from the discharge by a perforated pipe connected with air compressors extending in the direction of flow for about a mile. It is believed that this treatment would impart the normal content of dissolved oxygen to the water, prevent bad odours, and maintain fish life.

BEET PESTS.—In some parts of the United Kingdom the young plants of mangel and beet are being somewhat severely attacked by maggots of the mangel fly, the effects of which are serious, especially as weather conditions are against rapid growth. It is recommended by the Ministry of Agriculture,[2] that growth should be promoted as far as possible by lightly working the soil; and as soon as practicable a top-dressing of a soluble, quick-acting nitrogenous manure should be given. Plants already singled will benefit from rolling, but the real cure is rain and warm weather.

1 *Zeitsch. Ver. deut. Zuckerind.*, 1929, 79, 241-250.

2 Leaflet dated June 21st, 1929, issued by the Ministry of Agriculture and Fisheries.

A Study of the Waste-Waters from Beet Sugar Factories and Suggestions for their Disposal.

By WALLACE MONTGOMERY, Assoc.M.I.Mech.E.

The wastes obtained from the manufacture of sugar from the beet can be divided into two groups : those that can be further utilized and those that are, at present, a total loss. In the first group are the beet leaves and beet tailings recovered from the flume which may be used as stock feed ; also, in this group, is the beet pulp from which the sugar has been extracted. After the sugar has been extracted in the diffusion cells, the exhausted cossettes with the surplus water are pumped to a silo where the surplus water drains off.

In many plants this pulp, instead of being allowed to stand in a silo, is immediately dried by means of presses and various kinds of dryers. This process has been found to be economical. By drying it in this way, loss due to fermentation is avoided and a fine cattle food is procured. About 5 to 6 per cent. of the weight of the beets is thus recovered in a product somewhat similar to corn meal in composition and food value. In this form it is worth about ten times as much as the fresh pulp and eight times as much as the silo pulp.

Four wastes are produced that are not utilized in any way. After the water from the hot well, to which has been added fresh water direct from the factory supply, has been used to convey the beets from the bins to the factory, its character is changed greatly. It now contains beet leaves, organic matter obtained from the dirt surrounding the beets, sand and various living organisms. At some plants where the supply of water is limited, an attempt is made by screening and settling to improve this water that it can be used again for fluming.

Another of these unreclaimed wastes is the water that is drained from the exhausted cossettes as they enter the silo. As will be shown later in discussing the chemical composition of these wastes, it is high in organic and mineral matter. This water is conveyed directly to the factory sewer. Tests described later will show that this water as it enters the sewer is alkaline, but becomes strongly acid, if allowed to stand. It is therefore important that this water be conveyed to the sewer as quickly as possible, as after mixture with the immense quantity of fluming waste there is no chance for it to become acid.

The third waste is the silo drainage. The exhausted cossettes if not dried direct are allowed to remain in the silo for a number of months. If all surplus water is not drained off as pulp drainage waste, there is still a surplus that is allowed to seep from the silo along small ditches, which causes practically a perpetual nuisance in all seasons. This waste is the most concentrated of all, and would be the hardest to deal with if it were not for the fact that the dilution from the fluming waste and from the lime waste, which are strongly alkaline, obscure the strongly acid condition of this waste. This latter waste is entirely done away with by the method of pressing and drying of the pulp ; but, as it forms one of the most serious problems, it will be discussed here.

The fourth waste is the drainage water from the lime cake. This waste is highly mineralized and has a large amount of organic nitrogen. Mixture of this waste with the final factory waste is, no doubt, beneficial as it helps to neutralize the acidity of the silo drainage water. It usually has a very disagreeable odour.

As has been pointed out above, there are four different kinds of wastes from the manufacture of sugar that must be disposed of. They are : (1) Condenser water after fluming, or fluming wastes ; (2) Pulp drainage water ; (3) Silo drainage water ; and (4) Lime drainage water. We take these in the order mentioned.

FLUMING WASTES.

The most important waste from the standpoint of quantity is that for fluming the beets, i.e., the water used to carry the beets from the storage bins to the plant. This is usually obtained from the main water supply, and from the hot wells which seal the condensers and the condensates from the evaporators and pans. Although a large amount of this water is therefore really distilled, yet the following analyses (giving results in parts per million) of a factory supply water used for fluming show that some organic matter is taken over in the process of evaporation of the beet juice and is present in the fluming water.

	Factory Supply	Condenser Wastes Before Fluming
Turbidity	0	7
Sediment	—	Very slight
Alkalinity	195	185
Chlorides	57	92
Sulphates	430	310
Hardness	600	—
Iron	—	0·2
Suspended Matter :—		
Total	—	12
Fixed	—	6
Volatile	—	6
Residue on Evaporation	910	716
Loss on Ignition	194	156
Oxygen consumed	0·3	320
Nitrogen as :—		
Free Ammonia	0·008	6·32
Alb. Ammonia	0·001	0·24
Org. Nitrogen	—	2·0
Nitrites	—	0·145
Nitrates	0·18	4·95

This sample of fluming water shows the effect of the addition of the condensed water from the evaporators. There has been a reduction of sulphates from an average of 430 in the original water to 310 p.p.m. in the condenser water and also a reduction in the residue on evaporation from 910 to 716 p.p.m. All the results of the organic contents show a marked increase, especially in carbonaceous matter as represented by the oxygen consumed, which increased from an average of 0·3 to 320 p.p.m. There is also a marked increase in the nitrogen contents, but not so noticeable a one. This increase is not surprising, as the water in the diffusion must dissolve much organic matter that on evaporation is volatile enough to pass over with the condensate.

In its passage along the flume this condenser water naturally is changed in character. After leaving the beets at the beet wheel, it contains beet leaves, beet tailings, and much dirt washed from the beets. The nature of this change is noticeable in the results of a sample of the condenser water after use for fluming the beets, taken at the same time and in the same manner as the sample of the condenser water before use for fluming. The results are again in parts per million.

	Condenser Waters before Fluming	Condenser Wastes after Fluming
Turbidity	7	450
Sediment	Very slight	Moderate
Alkalinity	185	265
Chlorides	92	135
Sulphates	310	340
Hardness	—	—
Iron	0·2	10·0
Suspended matter :—		
Total	12	780
Fixed	6	668
Volatile	6	112
Residue on Evaporation	716	1630
Loss on Ignition	156	560
Oxygen Consumed	320	300
Nitrogen as :—		
Free Ammonia	6·32	4·70
Alb. Ammonia	0·24	2·20
Org. Nitrogen	2·0	14·40
Nitrites	0·145	0·100
Nitrates	4·95	4·95

As was to be expected from the nature of the pollution of this water, the greatest increase was in the mineral contents, the suspended matter increasing from 12 to 780 p.p.m. and the residue on evaporation from 716 to 1630 p.p.m. There is also an increase of 620 per cent. in the organic nitrogen content. It is somewhat surprising that there was no increase in the nitrates, as it might be expected that the nitrates in the soil that cling to the beets and are washed off by the water would affect this determination.

Pulp Water Wastes.

After the sliced beets have been extracted in the diffusers, the cossettes are pumped to the dryer or silo. A sample of this pulp water shows the following composition in parts per million :—

Turbidity	1500
Colour	60
Sediment	much
Alkalinity	150
Chlorides	74
Sulphates	310
Hardness	—
Iron	2·8
Suspended matter :—	
Total	1064
Fixed	200
Volatile	864
Residue on Evaporation	3025
Loss on Ignition	2070
Oxygen consumed	1290
Nitrogen as :—	
Free Ammonia	6·00
Alb. Ammonia	11·2
Organic Nitrogen	64·0
Nitrites	0·020
Nitrates	1·95

The organic contents of this waste are very great. It carries an immense amount of carbonaceous matter as shown by an oxygen consumed of 1290

p.p.m. The organic nitrogen is also worthy of notice, the amount being 64 p.p.m. The alkalinity was 150 p.p.m. This alkalinity is only temporary; and when allowed to stand these wastes turn acid in about 24 hours and remain acid indefinitely.

Silo Drainage Wastes.

The appearance of this waste varies greatly from time to time. At times it is comparatively clear, then in a short time becomes full of suspended matter mostly small pieces of pulp, thus causing sudden changes in the composition of the drainage water. It is the most offensive waste of all in the factory, due to the very noticeable sour odour. A sample showed the following analysis in parts per million :—

Turbidity	1100
Colour	700
Sediment	much
Acidity	7430
Chlorides	95
Sulphates	204
Hardness	—
Iron	28
Suspended matter :—	
Total	916
Fixed	232
Volatile	684
Residue on Evaporation	10200
Loss on Ignition	7900
Oxygen consumed	3060
Nitrogen as :—	
Free Ammonia	12·8
Alb. Ammonia	22·0
Organic Nitrogen	86·4
Nitrites	0·0
Nitrates	30·0

It is to be noted that the pulp water changes from alkaline to acid in the silo. The effect of the fermentation of the pulp is very evident. This waste is the most concentrated of all produced in the manufacture of beet sugar. Fortunately the quantity is small. As will be shown later, when mixed with the other wastes of the plant its particular characteristics that would cause trouble in designing a suitable treatment plant are largely obscured.

Lime Drainage Water.

Ordinarily the waste lime from the filter-presses is mixed with water and allowed to flow by gravity to large lagoons where it settles and the sediment allowed to stand until dry enough to be shovelled into wagons and carted off for fertilizer. The supernatant liquid either evaporates or overflows into the waste ditch of the factory. This water has a very disagreeable odour. A sample shows as follows :—

Turbidity	625
Colour	180
Sediment	Very slight
Alkalinity	850
Chlorides	60
Sulphates	365
Hardness	1800
Iron	—

Suspended Matter :—	
Total	152
Fixed	32
Volatile	120
Residue on Evaporation	3310
Loss on Ignition	1500
Oxygen consumed	500
Nitrogen as :—	
Free Ammonia	0·200
Alb. Ammonia	1·16
Organic Nitrogen	18·80
Nitrites	0·00
Nitrates	0·10

As would be expected, the mineral content of this waste is high. This high alkalinity helps to neutralize the high acidity from the silo drainage water. There is also considerable organic matter present. This is due to the impurities taken out of the beet juice in the process of filtering.

Final Wastes.

The combined wastes show a composition of the following :—

Turbidity	1200
Colour	—
Sediment	much
Alkalinity	560
Chlorides	70
Sulphates	244
Hardness	1085
Iron	6·0
Suspended Matter :—	
Total	1092
Fixed	784
Volatile	308
Residue on Evaporation	3168
Loss on Ignition	1460
Oxygen Consumed	330
Nitrogen as :—	
Free Ammonia	7·4
Alb. Ammonia	7·6
Organic Nitrogen	23·4
Nitrites	6·30
Nitrates	1·44

Compared to other industrial wastes, sugar factory wastes are usually lower in organic nitrogenous matter ; the carbonaceous matter is lower than for the creamery and cannery wastes, but greater than for the packing house wastes. In general, judging from chemical analyses, the wastes, under discussion, should be no more difficult to handle with known methods of treatment than other wastes, as we propose to show.

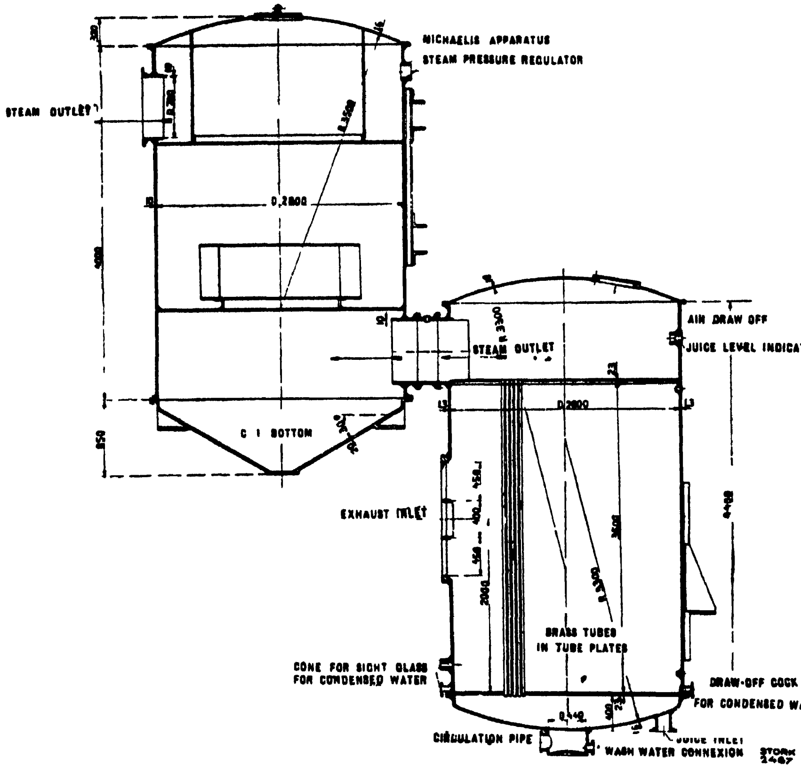
(To be Continued).

Leach's Argentine Estates.—For the 1928-29 season Leach's Argentine Estates made a net profit of £8,500, which compares with a loss of £116,400 in the previous year. This small profit, which is transferred to reserve account has been obtained thanks in a great measure to the continued exercise of strict economy in all departments ; but as limitation of production is still in force the estate was not able to work to full capacity.

Java Technical Notes.

A VISIT TO THE GOENOENGSARI S.F. **H. A. C. van der Jagt.** *Verslag eener Reis ter Bestudeering der Suiker-industrie op Java,* 93-96.

Described as a "super-modern" factory, Goenoengsari (and its sister sugar-house, Semboro) are to be regarded as the result of lengthy considerations on the part of the technical and chemical advisers of the H.V.A. on the one hand and of the agents of the machinery manufacturers on the other. It is equipped with water-tube boilers having a working pressure of 19 atmos. Steam is superheated to 350°C., and is led into two turbines both 1000 K.W., the first (D.C.) serving the milling installation, and the other (A.C.) the engines and pumps of the rest of the factory. Automatic registration of power



EVAPORATOR BODY.
(900 sq. m. heating surface as installed in the Goenoengsari s. f., Java.)

and steam consumption, temperature variations, and the like, is operated at every point where practicable; and the whole working of the milling plant consisting of a crusher and 5 units can be controlled from a captain's bridge. The concentrating plant consists of a Kestner pre-evaporator, two semi-Kestners, and three ordinary bodies. The Kestner obtains its steam from two accumulators containing steam at 12 atmospheres, which is reduced to about 3 atmospheres on leaving. When it enters the Kestner, it meets with vapour from the turbines having about the same temperature and pressure. Thin-juice coming from the sulphiters is heated in two pre-heaters to as high a temperature as possible before entering the Kestner body, so as to avoid giving this the duty of a pre-heater. The first of the two pre-heaters obtains

vapour from the second body, and the second from the first body of the evaporator. The exhaust steam supplied to the vacuum pans can be supplemented, if eventually necessary, by steam from the accumulators. The raw juice pre-heaters and those for the first carbonatation juice, are heated by vapour from the second body. In the evaporator instead of the Hodek, proved to be inadequate, the "save-all apparatus used is the so-called Cyclone juice-catcher, which is capable according to DE HAAN of saving 1080 piculs of sugar throughout an ordinary campaign in an average-sized sugar-house. Another improvement in the evaporator plant is the easy method which has been devised for opening up the semi-Kestners from above, so that cleaning can be facilitated. This is due to Mr. C. G. M. PERK, chemical adviser to the Ned.-Ind. Landbouw Mij. What is very apparent about this factory is the high boiling house, which is in four stages. On the uppermost, one has the thick-juice (syrup) sulphitation apparatus ; on the third the storage tanks for thick-juices and syrups ; on the second the pans ; and on the first the crystallizers, which are entirely enclosed vessels for vacuum or pressure working at will.

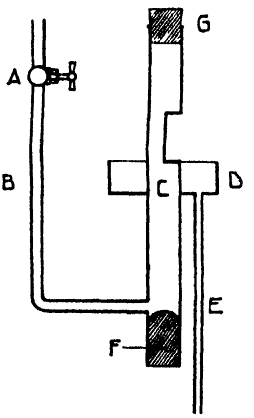
PRESSURE EVAPORATION IN CANE SUGAR FACTORIES. **P. Honig and J. F. Bogtstra.** *Archief, deel III, Mededeelingen*, 1929, No. 14, 689-834.
In the introduction a survey is given of some previous work in Europe on pressure evaporation in connexion with beet juices,[1] after which follows an account of the experiments carried out lately in the Soemberdadi and Kentjong factories with the object of examining the results with cane juices clarified by the sulphitation process, this work supplementing a previous report on the subject.[2] A standard triple effect was used, the juice temperatures being respectively 114, 108 and 102°C., and a special juice level regulator recently patented by Boulogne was installed. Analyses of the juices entering and leaving the bodies made continuously during the trials showed that, provided that the tubes are clean, no drop of the purity or glucose-ratio can be detected while the density is being raised to 50° Brix. Nor was there any marked coloration of the juice, though it was observed in pressure evaporation that the acidity increased, due probably to the decomposition of non-sugars. But here with sulphitation juice the incrustation formation was the difficulty, much more so than in the carbonatation trials already reported,[3] and this had a great effect in lowering the capacity of the apparatus. True that the addition of ½ per cent. of infusorial earth to the evaporator juice wholly altered the physical nature of the incrustation, making it softer than usual; but this modification appeared yet more to lower the transmission. Although on the whole the amount of incrustation in the pressure apparatus was only a little greater than in the factory evaporator, the effect in the former case is of more importance, seeing that a pressure evaporator must work at its full capacity to avoid juice decomposition. Pressure evaporation, therefore, cannot be recommended in dealing with sulphitation juices, the prevention of incrustation not being possible. An incidental point in connexion with the examination of the incrustations is that those from the pressure apparatus were found to contain more magnesium oxide than the others. Another part of this contribution deals with experiments made with the experimental evaporator designed by the French engineer ORTH :[4] and a point emerging from these, and an interesting one, is that an acid or a slightly alkaline juice of 20° Brix can be heated for a comparatively long time at

[1] *I.S.J.*, 1929, 86, 89, 154. [2] *I.S.J.*, 1928, 329 ; 1929, 121.
[3] *I.S.J.*, 1929, 212. [4] *I.S.J.*, 1927, 166.

110°C. without any modification either of the purity or of the glucose ratio being detectable. Juice at a *pH* of 5·9, for example, was heated 18 min. at 110°C., without these figures being affected. In explanation of this, it is suggested that the temperature coefficient of the *pH* may be different for different juices. In general the position in regard to pressure evaporation in cane factories appears to be that with carbonatation, sulphitation and defecation juices, triple effect evaporation under pressure with 114°C. in the first body causes during concentration to 50°Brix no more sucrose and glucose decomposition than in vacuum evaporation provided the concentration takes place during a time not exceeding 9 mins. and at the correct reaction. Probably concentration to 60°Brix can also be effected under the same conditions. Incrustation of the tubes must be avoided. With carbonatation juices this can be realised sufficiently by combining a correct clarification, a proper thin-juice sulphitation, and a good circulation in the evaporator bodies. But with sulphitation and defecation juices, owing to the impossibility of preventing incrustation to any marked extent, pressure evaporation cannot be advised.

CONTINUOUS BRIX-READING DEVICE FOR FILTER WASH-WATERS. **Chr. N. Nielsen.** *Archief, Verslagen*, 1929, *Afl.*, No. 2, 65-66.

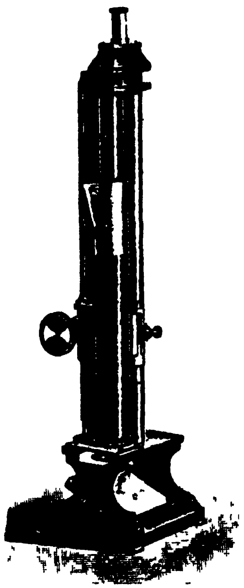
At the meeting of the chemical and technical sections of the Advisers, held this year at Soerabaia, it was pointed out to be necessary in connexion with new filters, as the Sweetland and the Vallez, to use some kind of device by which the Brix of the juice and wash-water may be read. The sketch shows an apparatus which has been installed at the Goenoengsari and Semboro factories. A part of the juice from the central juice line flows via *B* through the MOLL's cylinder *C*, an iron tube from the side of which a section has been removed. It passes into the small over-flow tank *D*, and from thence by the tube *E* into the collecting tank of the filter. When the cylinder *C* has been filled, the rubber stopper *G* previously inserted is withdrawn, and a Brix spindle is lowered into it, a layer of mercury at *F* acting as a cushion for the end of the instrument. By means of the small cock *A*, the passage of juice through the apparatus can be regulated, and its Brix is read as desired from time to time through the opening in the side of the cylinder. Such an apparatus is necessary, says the author, for controlling the extent of sweetening-off in Sweetland filters, especially to avoid the use of an abnormal amount of water. Following the reading of the paper, Dr. HONIG remarked that owing to the high temperature of the wash-waters, about 80°C., it might be advisable to make the spindle of Pyrex glass, to avoid breakage.



MEASUREMENT OF COLOUR IN THE SUGAR INDUSTRY. **P. Honig and J. F. Bogtstra.** *Archief, deel III, Mededeelingen*, 1928, No. 1, 1-35.

In this publication a review is given of the different types of instruments used for measuring the colour of sugar solutions. There are the classical Stammer and Dubosq colorimeters, which measure the intensity rather than the character of the colour, the first using standard glasses, and the second

a standard liquid. In employing these, and other instruments operating on a similar principle, a great source of error arises from the difference of tint between the standard and the liquid under examination. due to the colour components not being the same in both cases. Thus, for example, when a liquid has been treated with decolorizing carbon more blue may have been removed than other primary colours, leaving a filtrate which contains more yellow and red. Such errors are avoided largely by the use of the Lovibond tintometer with its coloured glasses, the design of which instrument may be regarded as being intermediate between the older and the newer methods of colour estimation. It is favourably regarded by BARDOFF and BALL[1] and others for examining sugar-house liquors, though a recent report[2] states that the colour of the normal glasses is not quite constant, so that an exact comparison of the values obtained is not possible. Newer types of instruments, on the other hand, such as the Hess-Ives, the Donnan-Lundén colorimeter, the König-Martens spectrophotometer, the Hilger wave-meter, and the "colour-analyser" of the Keuffel & Esser Co. afford the possibility of exact results by giving absolute values for the recognition of the whole of the spectrum. Factors affecting the colour of sugar solutions are the actual acidity, or *pH*, as is well recognized, the concentration (a liquid may be yellow when dilute, and reddish when in the state of syrup), and the degree of dispersion of particles that may be present in it. LUNDÉN'S amethyst colour[3] is of great importance in the cane sugar industry, that is the colour showing a strong absorption in the yellow part of the spectrum, and juices containing it must be regarded as inferior. It is very difficult to remove, and it crystallizes out with the sugars, it is, in fact, a nuisance to the white sugar manufacturer. Following this, experiments are described in which the extinction coefficient for red 625, yellow 575, green 535, greenish-blue 500, and blue 465 mμ have been determined for different factory products. So-called "colour curves" (plotting the extinction coefficient against the wave length at 2, 7, 10, and 12 *pH*) for raw, clarified and evaporated juices at different dates during the season are shown to demonstrate the varying colour quality especially in respect of the amethyst shade. Such colour curves are regarded as valuable for judging the worth of methods of juice clarification, as indeed is demonstrated in sulphitation tests with and without phosphoric acid addition, juices which were much superior from the colour point of view being obtained when the reagent named was employed. Lastly, attempts were made to obtain measurements of the colours of Java white sugars (using quite an inferior sample), but the Hess-Ives photometer failed here, the colour being too light. Only the extinction in the left part of the spectrum could be measured, the results obtained being considered insufficient criteria of the quality of such a product.



Stammer Colorimeter.

1 "Elements of Sugar Refining." Page 224 *et seq.*
2 Bureau of Standards, Scientific Papers, No. 547; *I.S.J.*, 1927, 550.
3 *I.S.J.*, 1927, 335.

Beet Factory Technical Notes.

Tare Determination.—In an article entitled "Experiences of the past Campaign," Dr. S. THIELER[1] gives some particulars of a sampling apparatus, which is claimed to solve the problem of accurately determining the dirt tare, that question often the cause of vexation between farmer and factory. It is called the "Rüpro," and is really only a large probe. It consists of a rectangular box, the lower part of which contains two knives, which cut vertically through the mass of beet, and close as soon as the bottom of the truck is reached. By means of compressed air at 6 atmospheres (90 lbs.) the probe is forced down through the mass of roots, abstracting a sample of all the material in its path. Depending on the height of the load of beets in the truck or other vehicle, a sample of 30 to 60 lbs. is thus withdrawn. It is quickly weighed on a "Tacho" rapid weighing machine, washed, and re-weighed, the dirt present being at once ascertained from a special table. Experience with the apparatus has shown that it gives results comparing well with careful tests of the tare as made by the hand selection of roots taken here and there from the trucks, besides being appreciably quicker. Such an apparatus should be accepted by the farmers and factory as a just means of deciding the tare. Anyway, so satisfied have both parties been at Stralsund, Germany, after a critical test, that they have ordered two.

Pulping for Analysis.—A point to be borne in mind by chemists concerned with the preparation of the pulp for analysis is the extent of the loss of water by evaporation that occurs to a greater or less degree even at ordinary temperatures. Under some conditions it may be such as to affect appreciably the figure for the sugar content. B. ZIMMERMANN[2] exposed 500 grm. portions each of beet slices and pulp to the air at different temperatures and degrees of atmospheric humidity, and weighed them from time to time during intervals of 2 hours, using a balance capable of carrying 10 kg. with a sensitivity of 0·01 grm. In the first half-hour the loss of weight owing to the evaporation of water was such as to increase the "digestion" or polarization result from 18·0 to 18·13 per cent. for slices, and from 18·0 to 18·10 per cent. for pulp. This was at 20°C., and a relative humidity of 41·2 per cent. Other experiments showed that during the preparation of pulp by means of the "Keystone" machine (official in Czecho-Slovakia), the loss in weight corresponded to an increase in polarization of practically 0·1 per cent. That was during 8 mins. One can see, therefore, that here is a source of error that should be borne in mind. It should be checked up to determine its extent for the particular conditions of working during the preparation of the pulp for analysis.

De-liming Juices.—Sulphurous acid used in the clarification of beet factory juices is known to act very beneficially in reducing colour and viscosity; but the important question which has received attention of late[3] is how it may best be applied for the removal of the lime salts. WEISBERG's process, so called "French saturation," has been much discussed[4] recently in this connexion, but generally speaking is not favoured in Germany. It consists of the following stages: Liming, first carbonatation, filtration, sulphitation, treatment with lime, second carbonatation, and filtration. In a recent paper by ERNST THIELEPAPE and PAUL MEIER,[5] of the well-known German beet sugar factory, Maltsch-Dietzdorf, WEISBERG's process is definitely stated to be unsuitable for the elimination of lime salts. It is otherwise disadvantageous as well. A large proportion of the sulphurous acid used goes into the calcium

[1] *Centr. Zuckerind.*, 1929, 37, (*Festausgabe*), 571-573.
[2] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 53, No. 44, 554-558.
[3] *I.S.J.*, 1928, 476, 549, 600; 1929, 270, 383. [4] *I.S.J.*, 1928, 477.
[5] *Zeitsch. Ver. deut. Zuckerind.*, 1929, 79, 176-193.

sulphite precipitate, and is therefore used rather as a precipitating than as a bleaching agent, which latter really is its proper function. Besides, some of the calcium sulphite remains in solution in the clarified juice, and deposits during concentration in the evaporators. A much better method of applying the SO_2 is claimed to have been devised by the writers, this consisting in the following steps : Liming, carbonatation at 90°C., filtration, sulphitation to slight acidity, neutralization by sodium carbonate, and lastly boiling-up. A comparison made between WEISBERG's and the new process showed the superiority of the latter, the lime contents in the two finally clarified juices being 0·0197 and 0·0016 respectively. A lighter juice is also obtained in the new method, and without the formation of a trace of invert sugar. Here are some figures obtained in applying the new process : Filtered carbonatation juice having an alkalinity and lime content of 0·026 and 0·0358 was sulphured to an acidity of 0·012, treated with sodium carbonate and boiled up for ten minutes, then giving an alkalinity figure of 0·032 and a lime content of only 0·0016. A modification was found to give equally good results, this being distinguished as the "alkaline method of working" : It consists in adding the sodium carbonate before the second carbonatation and then reducing the alkalinity by means of sulphur dioxide to the required figure. Starting with a juice containing 0·078 of lime, this was reduced to 0·0020 by the acid and alkaline methods of working with SO_2 devised by the writers, whereas the figure for the juice clarified by WEISBERG's process was 0·0320.

Filter-press Cloths.—Dr. K. SANDERA,[1] of the Sugar Experiment Station, Prague, has been investigating in the laboratory the various possible harmful effects on the durability of filter-cloths, his object in view being if possible to elaborate a specification based on physical and chemical tests that would be of value in estimating the quality of various material. For example, breaking tests of new and used cloths of cotton, linen and jute, and mixtures of these, were examined, as were also tests in which the layers of fabrics were compressed under conditions as closely as could be duplicated of filter-press work. High pressure on a layer of cloth, as occurs when the frames of the press are tightened up diminishes greatly its strength, as shown by the breaking strain test. An especially harmful influence is the presence of irregularities on the surface of metal in contact with the layer of cloth, as may be caused by grit. Under such tests cotton and linen behave better than jute. Rust forming on the surface of the cloth very greatly deteriorates its strength. In dressing or undressing a press, the frames may be knocked quite violently together so as to strike that part of the cloth which is pressed together in the frames. A hammering test devised to imitate this condition showed the strength of the cloth to be diminished thus. Here again cotton is the most resistant fabric. In another series of experiments, different cloths were artificially incrusted, and the effect of this on the rate of filtration was determined. Little difference occurred in the case of distilled water, but in the case of molasses solution the rate was distinctly impeded by the incrustation. Cotton and linen here again behaved better than jute. This work on determining the durability of cloth for filter-press work is admittedly incomplete. Other possible factors have yet to be examined in order to discover the reason why some factories in Czecho-Slovakia change once in three days and others only every 30 days.

Evaporator Losses.—It is of course well recognised that quite a serious loss of sugar may occur in evaporation bv the entrainment of juice, and it is

1 *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, 53, No. 46, 569-576. See also *I.S.J.*, 1929, 270, for a previous report by Dr. SANDERA.

also realized that much remains to be done in the direction of satisfactorily preventing this happening. It is a problem to which W. J. PENARD,[1] who has had considerable experience in Java, and is now connected with the Hallische Maschinenfabrik, has given some close attention. One of the principal causes of sugar passing into the condensed water of the evaporator is believed to be found in air-leaks, and in Java every well-conducted factory carefully tests for these, the greatest care being given to the packing of the various fittings. Slide valves are one of the commonest sources of air inlet, and a special improvement to obviate this has been devised. Accidental leaks may anytime occur, but whatever may be the way by which air may enter it sets up vortices of juice and syrup which in spite of save-alls of the Hodek type pass into the condensed water. Centrifugal devices are better, but do not always lead to a certain result. The firm with which the author is connected is now constructing improved centrifugal catchers placed in the top of the body of the evaporator, the customary vapour-space no longer being present. In explanation of the difficulty of dealing with entrainment in the evaporation plant, the author states that juice which is carried over from one body to the next is superheated when it leaves the mouth of the inlet tube, and forms a spiral containing sugar dust, more difficult to entrain in any form of catcher than is a liquid cloud. In order to trap this solid sugar, the surfaces of the separator must be kept wet. Apparatus of the construction above outlined is said to have justified itself in Java, and the same principle of entrainment prevention has also been applied to carbonatation tanks.

Heil Process.—Not a little interest has been aroused in Germany in the claims made for an after-product process invented and patented by FERD. HEIL, of the Woinowitz s.f., Germany. In a letter communicated to the *I.S.J.*, this inventor explains that his process in a general way consists of a special procedure both in boiling and in crystallizing, these two operations being interdependent, and that the result is "one can evaporate in a short time the most unclean syrups to a coarse-grained mass." Some particulars of the principle of the process have already been published in our columns.[2] Details of results obtained by the inventor[3], and by M. LENZ,[4] have now been published, and these are remarkable. In regard first to the boiling process, whereas in the ordinary way an after-product strike would require about 24 hours, according to the HEIL process it takes only 12 to 14 hours. In the crystallizing operation, instead of the usual four to five days necessary in separate vessels before the massecuite is ready for the centrifugals, it is now only 30 to 48 hours that are required in the inter-connected battery of crystallizers, the purity of the molasses being lowered at the end of this time without difficulty to 58 to 60°. It is claimed, further, that the after-product sugar can be washed up to give a white sugar almost as good as the first-product. It will be understood that such claims have caused some criticism. However, the HEIL process has recently been examined by Dr. SPENGLER, of the Germany Sugar Institute, so that this authority if he publishes his results may later put matters in a clearer light.

DR. J. DEDEK.—It is announced that Dr. J. Dedek, technical adviser of the A/S De danske Sukkerfabrikker, whose name as a contributor is well known to our readers, has been appointed Professor of Sugar Technology at the Technical University of Brno, Czechoslovakia.

1 *Die deut. Zuckerindustrie*, 1929, 54, No. 15, 369-371.
2 *I.S.J.*, 1929, 446. 3 *Deut. Zuckerind.*, 1929, 54, No. 18, 445-446.
4 *Centr. Zuckerind.*, 1929, 37, No. 18, 497.

English and Scottish Beet Sugar Companies.

Results of the Principal Undertakings for the 1927-28 and 1928-29 Seasons.

(Reproduced by permission from the *Financial Times.*)

In the table below are summarized the results of the operations of beet sugar companies in England and Scotland during the past two years. The number of undertakings is thirteen and practically all of importance are included. Details of the United Sugar Company in which TATE & LYLE is interested cannot be given, as that undertaking regards itself as a private enterprise, though it participates in a public subsidy. Figures of each individual undertaking have been reduced to a comparable basis, as far as feasible, so that the results of the past season may be set readily against those for the previous year. Trading profit is struck before allowing for interest and taxation. Whether the figures are given before or after allowing for depreciation is indicated. Net profit is struck after deduction of the charges mentioned above, but before allocations to general reserve and provision for such special purposes as preliminary expenses. The Government subsidy is included in both trading and net profits, but in their accounts the companies do not set forth the amounts separately. It is impossible to form any correct judgment of the operations of the companies individually without knowing the relation the subsidy bears to disclosed profits.

COMPANY.	Paid-up Capital.		Loans.		Trading Profit.		*ai*Net Profit.		Reserve Appropriation.		Depreciation Allowance.		Ordinary Dividend.		Carry-Forward.	
	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29	1927-28	1928-29
ANGLO-SCOTTISH GROUP—	£	£	£	£	£	£	£	£	£	£	£	£	Per Cent.	Per Cent.	£	£
Anglo-Scottish Beet Sugar Corp ..	425,000	442,900	731,500	688,700	209,400	*b* ,55400	44,800	10,700	nil	nil	100,000	20,000	nil	nil	*s* 88,600	*s* 97,800
Second Ang.-Scot. Beet Sugar Cp...	240,500	240,500	865,000	972,800	*b* 226,400	*rb* 37,800	24,400	*l* 3,000	nil	nil	122,500	nil	nil	nil	*s* 23,200	*s* 18,800
West Midland Sugar Company ..	180,000	180,000	139,200	109,200	*b* 148,900	*b* 67,900	57,900	33,600	35,000	nil	56,000	19,000	*c*12½	*c*10	36,000	51,000
ANGLO-DUTCH GROUP—																
Ely Beet Sugar Factory	450,000	450,000	10,000	nil	*a* 167,000	*a* 168,200	102,500	115,232	46,200	59,000	138,500	102,600	*c*12½	*c*12½	nil	nil
English Beet SugarCorporation ..	500,000	500,000	nil	nil	*a* 217,900	*a* 177,600	169,900	103,800	69,900	3,800	85,400	25,000	*c*20	*c*20	nil	nil
Home Grown Sugar	125,000	125,000	69,700	50,900	*b* 82,200	*b* 18,600	29,300	*l* 14,400	26,200	*u*nil	24,600	25,500	5	5	nil	nil
Ipswich Beet Sugar Factory......	400,000	400,000	nil	nil	*a* 160,000	*a* 67,800	112,600	50,600	62,600	300	52,400	20,000	*c*12½	*c*12½	nil	nil
King's Lynn Beet Sugar Factory..	450,000	450,000	15,000	54,000	*a* 73,200	*a* 67,600	*e* 50,400	36,800	700	800	37,300	20,000	*c*10	*c*8	nil	nil
ANGLO-AMERICAN GROUP—																
Central Sugar Company	175,000	175,000	130,600	80,200	*b* 98,300	*b* 94,300	29,600	43,600	nil	nil	21,900	20,600	*c*10	*c*10	43,500	69,600
Lincolnshire Beet Sugar Company	332,500	332,500	225,000	*f* 367,800	*bg*151,100	*b* 46,000	*g* 51,100	11,300	nil	nil	25,000	11,000	*d*nil	*dd*nil	1,500	11,300
Yorkshire Sugar Company	196,900	196,900	195,000	150,000	*bh* 74,700	*b* 36,100	*h* 12,900	10,800	nil	nil	20,000	9,000	5	nil	1,300	2,100
UNATTACHED UNDERTAKINGS—																
British Sugar Manufacturers	348,100	348,100	320,400	297,700	48,300	50,000	*j* 24,300	27,600	nil	nil	nil	27,600	nil	nil	*k* 59,500	*k* 59,500
Shropshire Beet Sugar Company	354,600	354,600	nil	nil	*b* 55,000	*b* 72,900	16,700	33,100	nil	nil	10,000	15,000	*m*nil	*mm*nil	4,100	7,100

a After depreciation allowance. *b* Before depreciation allowance. *c* Tax free. *d* 7 per cent. on Participating Preference. *dd* Nil on Participating Preference. *e* For fourteen months. *f* Including debentures for £175,000 issued as security for guarantee. *g* For fourteen and a half months. *h* For thirteen months. *i* Income tax deducted. *j* No allowance for depreciation. *k* Debit balance. *l* Loss. *m* 5 per cent. paid on Preferred Ordinary. *mm* 6 per cent. on Preferred Ordinary. *r* Including transfer from reserve not now required. *s* Subject to directors' fees. *u* £17,500 withdrawn.

Publications Received.

The Ship Captain's Medical Guide. Edited by D. D. F. Macintyre, M.B., Ch.B., V.D., Surgeon Commander, R.N.V.R. Prepared and issued by the Board of Trade; 17th edition. (H.M. Stationery Office, London). 1929. Price : 2s.

Described by an authority as "the best medical hand-book in the world," this small crown 8vo. volume contains in the compass of its 292 pages a surprising amount of information concerning what should be done in the absence of a doctor. It gives hints on the diagnosis of disease and instruction in bandaging; it advises how one should deal with bleeding, wounds, burns and scalds, inflammation, fevers, and poisoning. It describes diseases of the respiratory and digestive systems, of the kidneys and bladder, of the eye and ear, and of the skin, giving in clear language the most appropriate treatment to be followed in the meantime. Doses and directions are given for the use of medicines, and the book is concluded with a "case-stating scheme" for assistance in compiling a message of call for medical advice. A remarkably practical medical aid, intended primarily for emergency use on the high seas, it may well be recommended for the same purpose to all living in isolated places. It is an outstanding example of a cheap article that is indeed very good.

Handbook of Chemistry and Physics. By Charles H. Hodgman and Norbert A. Lange. Thirteenth Edition. (Chemical Rubber Publishing Co., Cleveland, Ohio, U.S.A.). 1929. Price : $5·00.

This book is a ready reference pocket book of chemical and physical data, which is largely used in the United States. It contains an immense amount of data in a condensed form, and is provided with an excellent index making this information readily accessible. Its various sections comprise: mathematical tables, general chemical tables, properties of matter, heat, hygrometric and barometric tables, sound, electricity and magnetism, light, miscellaneous tables, definitions and formulae, and measures, and units. Among the several laboratory handbooks we know of none presents so large an amount of accurate, important, and up-to-date information within its covers as does this. Its general arrangement is excellent, and we can recommend the Handbook with confidence to chemists and physicists generally.

Histoire Centennale du Sucre de Betterave. (Syndicate des Fabricants de Sucre de France, Paris.) Price : 150 francs.

This is a splendidly edited album, 11½ in. × 14½ in., commemorating the Centenary of the foundation of the beet sugar industry in France, which is deemed to be 1812. Its many illustrations are reproduced from papers and pictures in the collection of M. Jules Hélot, the hon. general secretary of the Syndicate des Fabricants de Sucre de France. By reason of its historical reviews, and especially its many reproductions of old prints, documents, licences, cartoons, and portraits, this is a publication of considerable interest to the student of the history of the sugar industry.

De Brix-Bepaling van zeer verdunde Suikeroplossingen. Th. J. D. Erlee. (Van Ingen, Soerabaia, Java). 1929. Price : Fl. 0·75.

This is a 15-page booklet of tables for ascertaining the Brix of very dilute solutions, given the corresponding sp. gr., which determination is now assuming importance in Java in connexion with the direct determination of the Brix of the last mill juice.[1] Temperature correction tables also are given.

Methods of Clarifying Sugar Solutions for Analytical Purposes. M. I. Nakhmanovitch and S. L. Berman. (Institute for the Sugar Industry, Kiev, U.S.S.R.) 1929.

This is a very complete study (in Russian) of the extensive literature that has accumulated in connexion with the question of clarifying sugar solutions preparatory to polarizing them. It contains no fewer than 327 references. These Russian authors are to be commended on their very thorough monograph, some extracts from which will be found elsewhere in our columns.

---

[1] *Archief*, 1929, 37, I., No. 22, 557-570.

Brevities.

PROPOSALS AT GENEVA.—The French delegation in Geneva have requested the Council to convene a meeting of the representatives of the Governments concerned for the purpose of bringing about international agreement with regard to the price of sugar, so as to overcome the existing disparity between production and consumption.

SAND FILTERS.—A sand-filter, constructed by the Java Experiment Station, and put into operation during the past campaign for concentrated solution, as evaporator syrup, was found to demand a great quantity of wash-water.[1] Per sq. metre (10·76 sq. ft.) of filtering area, corresponding to a charge of 1800 kg. (3968 lbs.), as much as 100 hl. (2200 gall.) of water were required.

RAT CONTROL.—R. W. Mungomery, Assistant Entomologist, of the Bureau of Sugar Experiment Stations, Queensland, advised in a recent report that first the shelter and breeding ground of rats must be destroyed.[2] The best bait to use is the barium carbonate biscuit, which has given such good results in the different districts, being cheap and effective and not highly poisonous to stock, dogs or humans.

"AMMONPHOS."—Comparison in field trials with the two grades, the 20/20 and the 13/48, of this concentrated fertilizer, led G. BOOBERG[3] of the Sugar Experiment Station, Pasoeroean, Java, to conclude that they may be used without disadvantage to displace equivalent quantities of sulphate of ammonia and of superphosphate. In most of the experiments the same remark was found to apply also to Diammonium phosphate I. G., a similar preparation produced in Germany for fertilizer purposes.

IRISH SUGAR.—The Irish Sugar Manufacturing Co., Ltd. for the year ended June last made a net profit of £127,140, which compares with £117,111 in 1927-28, and £50,240 in 1926-27. The sum of £60,000 has been applied in payment of a dividend of 15 per cent. free of tax; but since, as the *Financial Times* points out, the subsidy from the Irish Free State was about double the profit secured, it is evident that the problem of running the plant remuneratively without Government aid has yet to be solved.

RAFFINOSE.—This rare sugar, present in the molasses from beet sugar factories, is used to a limited extent by bacteriologists, and costs about £50 per kilo. W. H. Dahlberg,[4] however, claims to have worked out a process for its recovery from the final product of the baryta desaccharification method as operated at the Johnstown plant of the Great Western Sugar Co., U.S.A., according to which the cost will be $3 a lb. It may be of use, it is suggested, in candy manufacture for preventing the crystallization of sugar.

DUTCH SUGAR SHARES ACTIVE.—After several months of quiescence sugar shares have once more become an object of speculative activity on the Amsterdam Bourse, and some spectacular rises in quotations have recently occurred. The cause for this is undoubtedly the fact that the 1930 Java crop promises to fetch a higher average price than that of 1929; the opening sales have been for over 14 guilders, whereas the average for 1929 was between 12 and 13 guilders. The 1927 crop sold for an average of 17·76 guilders, and that of 1928 for 14·32 guilders.

BEET POSSIBILITIES.—Asa C. Maxson replies to the question as to why one cannot develop a single-germ seed ball, and thus do away with hand-thinning.[5] He says that the production of a single germ seed is comparable to securing a strain in which all the beets have 16 per cent. of sugar, which seems possible. In beet breeding what is really done is to raise the average, which is now about 19, ranging from 14-15 up to 21-22 per cent. After all, this range has not been materially raised over that of the wild beet, which may contain up to 14 per cent. of sugar. Nor can the natural range in the number of germs per seed ball be raised. Another point is that the multiple seed ball sends forth two or more plants, the combined power of which can break through the soil, whereas one often could not do so.

[1] *Archief*, 1929, 37, II, No. 29, 688. [2] *Aust. S. J.*, 1929, 161.
[3] *Archief*, 1929, 37, I, No. 12, 358-361.
[4] *Food Industries*, 1929, 1, No. 11, 484-486.
[5] *Through the Leaves*, 1929, 17, No. 5, 229-230.

MOLASSES AS FERTILIZER.—In Hawaii work has been carried out of late on the utilization of molasses as fertilizer, and mixings of this by-product with bagasse, filter-press cake, furnace ashes, and the like (so-called "Molash cake") have been found to give favourable results.

OLIVER FILTERS.—Installed in Baragua, Cuba, Oahu, Hawaii, Tinley Manor, Natal, and other factories in cane growing countries, the claims made for the Oliver in mud filtration are : a cake with a sucrose content of 0·8 per cent on weight of the wet material ; wash water required, 150 per cent. on the weight of wet cake ; filter-cloth consumption, about 100 per cent. of average using presses ; all the filtrate is bright and sparkling , and manual labour is practically eliminated.

JAVA'S INCREASE.—At the recent meetings of the German Association of the Sugar Industry, several speakers dealt with the increased production of the cane sugar industry. Dr. E. O. von Lippmann, for example, made the following point. Java in recent years has increased her production up to about three million tons, and that with extraordinary rapidity. But whereas the cultivated area has increased only about 1 per cent., the sugar production has increased 23 per cent. during the past two years.

PHILIPPINE SUGAR OUTPUT TO BE CURTAILED.—According to cable advices from Manila, the Philippine Sugar Association at its Convention held on September 20th unanimously adopted a resolution favouring the curtailment of new sugar production in the islands. The Governor had urged that any undue increase in the production would be regarded in the United States as a menace to the domestic sugar interests, and in view of the defeat of the attempt at Washington to tax imports of Philippine sugar, it was desirable not to aggravate the situation and have the question re-opened.

"META" FILTERS.—At the recent statutory meeting of Metafilters (1919) Ltd., it was stated that "the Company's patents covered a new system of filtration in which neither pulp nor cloth was required, with economy in labour, and renewals practically reduced to nil. They were already booked up for some time with orders from breweries alone, and the board considered there should be "little difficulty in earning substantial profits on the very moderate capitalization of a company which owned the world's rights as a scientific and revolutionary system for the filtration of all kinds of liquids."

THE H.V.A.—The great Dutch concern, the Handelsvereeniging "Amsterdam," founded some 50 years ago, now owns 15 sugar plantations (which in all produce 350,000 metric tons of sugar), four tapioca, and two rubber plantations in Java, besides six tea, four fibre, four rubber and two palm oil plantations in Sumatra.[1] It employs 1050 Europeans and more than 150,000 natives on these estates. All these enterprises, which to date have demanded 210 million Dutch florins, have been financed entirely from the profits of the concern. It works with a comparatively small amount of issued capital, viz., 40 million Dutch florins, the authorized capital being 80 million. Reserves amount to 20 million, i.e., 50 per cent. of the issued capital. During the past 42 years, the H.V.A. has paid dividends varying from 6 to 60 per cent., those from 1925 to 1929 having been 40, 35, 30, 30, and 30 per cent. By dividing the risk among different plantations with different crops, its independence of any possible depressions in the market for any one product is ensured.

GERMAN BEET INDUSTRY.—S. G. Ruegg[2] says that unless the German beet industry is assured a degree of security it has no future. The beet tonnage has declined, the soils having become "beet-tired" ; there is lack of labour ; the preparation of the soil is not scientific ; and there is no proper rotation of crops. Poor financial results are obtained, due to inability to adequately cultivate the soil, the faulty use of fertilizer, a lack of systematic effort, and the improper use of by-products. Moreover, the Government is unsympathetic in protective measures, and does not regulate the labour market according to needs. Besides, the whole agricultural situation is weighted down with taxes and the increasing cost of materials used in sugar manufacture.

1 *J. Fabr. Sucre*, 1929, No. 36. 2 *The Planter*, 1929, 83, No. 10, 181-182.

Review of Current Technical Literature.[1]

REPORT ON THE SUGAR MILLS OF JAVA. **Norman Bennett.** *Aust. S. J.*, 1929, **21**, No. **5**, 298-301.

The policy of the Javan industry in relationship to the research work of the Experiment Station must be particularly noted. The research work of the Chemical Section is done at excellently equipped laboratories at the Experiment Station at Pasoeroean; the application of the results obtained is then applied to factory work proper. At the same time, the section has attached to its staff several practical men whose advice on matters pertaining to chemical control or factory procedure is available at any time. The research work of the Engineering Section is done both in miniature at Pasoeroean and in actual practice at the mills. At the present time the Chemical Section is investigating the following problems :—(1) The structural alterations to the cane fibre as affected by various methods of preparatory devices and the subsequent effect of maceration with both cold and hot water. The most interesting point brought out to date is that ordinary methods of preparation for milling leave many of the juice cells of the cane unbroken. This must naturally affect the time factor and the efficient use of maceration water. The thermal death point of the cells has been determined at 130°F. (2) An investigation of Javan sugars with a view to improving colour, quality, refining value, etc., and the relationship of the various clarification systems, e.g., defecation, sulphitation, and liming on the final product. Ultimately this investigation will have a direct bearing on the various boiling systems in use. Apart from such work,[2] which is of a highly scientific nature, the section is conducting a system of uniform control of the re-agents used in the determination of hydrogen ion. In addition, a system of mutual control of the boiling house operations has been prepared by the Station staff, and the Javan mills forward their working figures to the Station every 15 days. This system of mutual control is also applied to the figures of milling work and to fuel control. The Engineering Department has the following problems in hand : (1) The application of pressure evaporation to cane juices. (2) The use of air pre-heating for boiler efficiency and fuel economy. (3) Extensive factory trials of variously designed bagasse furnaces. (4) The extended use of hot water maceration as influenced by the research work of the Chemical Section. In general, the standard size of the mills is 30 in. × 60 in., with a 30 in. × 60 in. crusher and a 12-roller plant. Preparatory knives are not used except in two factories, and the Krajewski type of crusher finds most favour. There are some mills which have neither crusher nor knives and these installations are usually equipped with a crusher top roll. The average tonnage of cane crushed is between 1000 and 1500 long tons per day, and the milling plant is in operation for 3-4 months of the year, between May and November. The milling work, judged on sucrose extraction figures, is not as good as in Hawaii; the final bagasse is very coarse and the quantity of imbibition water is usually under 20 per cent. on the weight of cane. There are only three electrically driven mills in operation—one installed in 1923 is driven by A.C. motors; the other two, erected in 1927 and 1928, are driven by D.C. motors of 250 h.p. Clarification processes used in the mills vary with the type of sugar produced, and three are in use : (1) Defecation—lime only, which produces Head Sugar of 16-18 Dutch colour standard having an average polarization of 98·4; and Muscovado Sugar 14-16 Dutch colour standard, with an average polarization of 97·5. (2) Sulphitation—usually the hot process in which the juice is heated to 75°C. before sulphitation, which produces, if the massecuite is submitted to double purging with steam drying in the second purge, a plantation white sugar of 25 Dutch colour standard and higher. (3) Carbonatation for the manufacture of white sugar only and a very low grade molasses sugar. Evaporators are usually of standard quadruple type with the heating surface of the first body double that of the other vessels. The extra heating surface gives a supply of steam which is used for the heaters or for one or two of the pans. Later types of evaporators tend towards a quintuple with the bodies of the semi-Kestner type, i.e., tubes of 3½ metres in length. The new factory, Goenoengsari, is equipped with a Kestner pre-heater and a quintuple with semi-Kestner bodies, and steam is bled

 2 The essential points of which have already been recorded in the *I.S.J.*

from the first and from the second body of the quintuple. The set is fitted with automatic juice regulation. At the boiling station the pans are usually of the coil type; these finding favour instead of the quicker boiling calandria pans. After purging, the sugar is passed through a dryer, and after drying is often elevated and allowed to drop against a draft of cool air. Boilers are usually of fire tube type; but water tube boilers generating steam at 12, and in the newer factories at 17 atmospheres are being installed. The boilers at the latter steam pressure are equipped with the Ruth steam accumulator. Firing is done by hand, due to cheapness of labour, and the furnace construction is of the sloping gate type. The design of the furnaces has recently been altered to give a longer fire bar and the step grate is closed to within 9 in. of the bottom to force the air through the grate. Many of the mills have a large surplus of bagasse, and this is baled during the crushing season and stored for subsequent use in the following year or for use in locomotives.

PLANTATION WHITE SUGAR REFINING, USING KIESELGUHR ("SUPERCEL"). **Arthur Elsenbast, R. D. Elliott and E. J. Sullivan.** *Ind. and Eng. Chem.*, 1929, 21, No. 7, 676-684.

From an article, entitled "Use of Super-cel in the Sugar Refining Industry," which deals with cane and beet factory and refinery practice, the following is extracted:—Plant-scale filtrations and trials over many seasons have clearly established that Super-Cel filtration on this type of syrup, wash, and remelts is cheaper and more effective than trying to produce a calcium precipitate or reaction that chemical treatment at this stage affords. The Super-Cel affords the plantation white sugar manufacturer the opportunity of filtering his syrups at densities up to 68° Brix and temperatures as low as 60°C. At such temperatures there is the maximum removal of precipitated colloidal matter as well as the removal of thrown out, insoluble salts. The use of Hyflo Super-Cel in the treatment of mud and scum settlings in a lime-sulphur white house is of vital importance. Customary practice is to add an excess of lime in order to make these muds filterable, but by just liming

FILTRATION OF PLANTATION WHITE, DIRECT-CONSUMPTION BROWN, AND RAW CANE SUGAR.

		Hyflo Super-Cel		Filter Area per 1000 Metric Tons Cane per day.	
Kind of Sugar	Liquor	Per ton cane *Kg.*	Brix solids *Per cent.*	Filter area per ton cane *Sq. m.*[1]	No. of 50 sq. m. presses
Sulphitation	Thin-juice	0·1 to 0·4	0·1 to 0·4	0·1	Three
	Evaporator thick-juice	0·3 to 0·8	0·3 to 0·8	0·15	Three
	Remelt	0·2	0·2 to 0·8	0·1	Two
Carbonation	Evaporator thick-juice	0·1 to 0·4	0·1 to 0·4	0·15	Three
	First molasses remelt[2]	..	..	..	..
D.C. brown	Evaporator thick-juice	0·6 to 0·8	0·6 to 0·8	0·2	Four
Raw cane	Mud and scum settlings	0·05 to 0·15	..	0·2 to 0·3	Four
	Thin-juice	0·5 to 1·0	0·5 to 1·0	0·1	Two
	Evaporator syrup	0·5 ro 1·2	0·5 to 1·2	0·15	Three
	Remelt	0·25	0·25 to 1·0	0·1	Two

mud and scum settlings to the alkaline side and using the proper quantity of Hyflo to render the muds filterable, from 10 to 25 per cent. of the total house juice is of higher grade than would be usually obtained. This has a direct effect on the quality of the finished sugar. Filtration of the thin-juice is easily effected with Hyflo Super-Cel, and by removing impurities from the juice at the very start of the process it produces cleaner, better syrups. The first bodies of the evaporators will remain cleaner through the mechanical removal of suspended matter. The coils in the last body, according to the juice, will have a certain amount of scaling through the salt concentration on evaporation. Filtration of the thin-juice makes syrup filtration easier and requires less filter area for the combined filtration than would be required if the syrup were filtered alone. The thin-juice press cake is not sweetened off,

[1] 1 sq. ft. = 0.09 sq. metre.
[2] Make up standard syrup filtering at highest Brix and lowest temperature.

but is sent to the mud and scum settlings and filtered with them. The filtration of the juice is the first step in the production of an absolutely brilliant plantation white sugar. The impurities which settle out of the syrup are partly crystalline and partly organic and inorganic precipitates. Filtration with Hyflo Super-Cel is carried out on the usual types of pressure filter-presses such as the Sweetland, Vallez, or plate-and-frame presses. Less filter area is used for the Hyflo Super-Cel filtration than for a filtration where lime and sulphur have been used for the thick-juice treatment. The Super-Cel filtration is always carried out at a heavier Brix and causes no difficulties as in the case when lime and sulphur are used. The Hyflo Super-Cel press-cake is sweetened off with hot water or thin-juice and then dropped from the press and returned and mingled with the mud-settling juices. These are then pumped to the mud settlings into the mud press, where they assist in the mud filtration and there is, therefore, no loss of thick-juice in the press cake. The sugar that is produced from this syrup crystallizes into a clean grain, which can be washed in the centrifugal machines with a minimum of water. Turbid thick-juice, when sent to the pan, produces a dull grey sugar which no amount of water can wash to a white sugar, but the syrup resulting from a Hyflo Super-Cel filtration, being sparklingly brilliant, produces the highest grade of lime-sulphured white sugar. If the thin and thick-juices have been filtered according to the above discussion, the remelt sugars present little difficulty for filtration, and minimum quantities of Super-Cel are necessary. In plantation white houses the remelt will usually run from 20 to 30 per cent. of the total sugar solids coming into the house. The cleaning up of this large proportion of the sugar solids will not only be of first aid to the white sugar production, but will also yield a direct benefit on the production of low-purity molasses and the smallest quantity of molasses. It is always advocated that all syrups going to the first pans for the production of final sugar be filtered, and for this reason any available filter-press area should be pressed into service for the filtration of the high wash from the white sugar centrifugals. This filtration requires approximately from 0·1 to 0·2 per cent. Hyflo Super-Cel on solids.

REMOVAL OF INCRUSTATION FROM EVAPORATOR AND HEATER TUBES. **H. B. Springer.** *Tropical Agriculture*, 1929, **6**, No. 8, 235.

Experiments were carried out on the cleaning of evaporator tubes in a factory at Berbice, British Guiana, where considerable difficulty was experienced in keeping the heating surfaces sufficiently clean to enable them to keep ahead of the mills. Analysis of the type of scale was as follows :—Moisture and loss on ignition, 25·88 ; Silica, SiO_2, 27·74 ; Phosphate, P_2O_5, 1·23 ; Sulphate, SO_3, 11·78. An attempt was first made to determine in the laboratory, the minimum concentrations of sodium fluoride and ammonium hydrogen fluoride,[1] which would have what was considered sufficient softening action on the scale. This was done by removing a tube from the fourth vessel of a quadruple—and one from the third vessel of a triple-effect evaporator. The tubes were cut into 2 in. lengths, and the sections thus obtained boiled for three hours with 1, 2, 3, 4 and 5 per cent. solutions of each of the re-agents mentioned. From the results of these tests, it was decided that 2 per cent. ammonium hydrogen fluoride was the best suited, and most economical, for the purpose. The concentration of sodium fluoride required to produce a similar effect was 5 per cent. In practice, it was found necessary to boil only the last effects of both triple and quadruple evaporators every week, and the third effect of the quadruple once in three to four weeks. The following procedure was used with good results :—Fresh 2 per cent. ammonium hydrogen fluoride was boiled for three hours, under 1 in. of vacuum to produce circulation in the effect to be cleaned, and run into a storage tank. Better results would undoubtedly be obtained by boiling under pressure ; but this would necessitate large and expensive valves on the vapour pipes of the penultimate effect. This used solution was made up to 2 per cent. concentration with new re-agent for use the following week, re-boiled and returned to storage. At the end of the third week, new 2 per cent. solution was used on the last vessels, and the partially spent

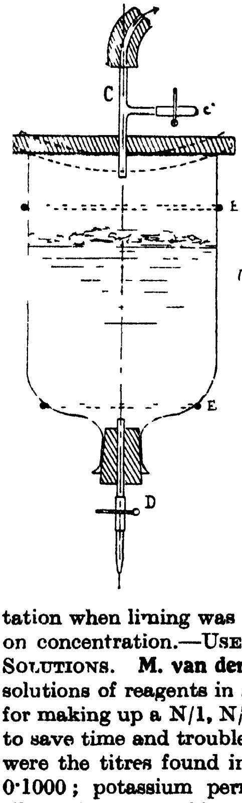
[1] See also VAN DER LINDEN, *I.S.J.*, 1923, 637.

reagent boiled in No. 3 quadruple. The loss during the boiling process described was approximately 60 per cent. of the initial fluorine. In all cases, the vessels were filled with water after boiling, and scraped wet. The scraping was greatly facilitated, and comparatively large quantities (100-120 lbs.) of softened scale removed from each of the last calandrias. The last used solution was found to be useless for further boiling, but was run into a separate storage tank, in which was thus accumulated the spent reagent from each cycle. This solution was utilised with very good results at the end of the grinding season being drawn into all the effects, and allowed to stand for two months or longer before hand cleaning was commenced. Any resulting surplus may be diluted and used with advantage on the pans. The cost of cleaning was increased by \$20 a week by the use of ammonium hydrogen fluoride; but this extra cost was more than counterbalanced by an increased evaporative capacity of about 25 per cent. and the consequent elimination of "Juice Room" stoppages on the mills, and increase in maceration. The steam efficiency of the factory, also, was improved, since less steam had to be used in single effect, and the various power units operated against a lower back pressure. It would be expected, also, that the life of the tubes would be lengthened.

SIMPLE AND RAPID DETERMINATION OF SULPHUR DIOXIDE IN CARGO SUGAR. **E. Haddon.** *S.A. Sugar J.*, 1929, **13**, No. 6, 331. Last year several complaints were made that the amount of SO_2 found in cargo sugars exceeded 70 p.p.m., going as high as 220. At Umfolozi the following simple and rapid volumetric method for determining SO_2 in sugars has been used: 50 grms. of sample dissolved in about 200 c.c. of freshly distilled water are mixed with 5 c.c. of a 30 per cent. solution by weight of sulphuric acid and 10 drops of 1 per cent. starch solution, and titrated with standard iodine solution, 1 c.c. of which = 0·001 grm. SO_2. A "blank" is carried out for the iodine-absorbing non-sugars, using again a solution of 50 grms. of the sample in 200 c.c. of water, but adding 5 c.c. of hydrogen peroxide solution, then after 2 or 3 min. the same amount of sulphuric acid and starch solutions, and re-titrating with the same standard iodine solution. This blank is deducted from the first result to give the actual SO_2 in the sample of sugar examined.—HIGH GRADE SUGAR RECLAIMED FROM LOW-GRADE BEET MOLASSES. **W. H. Dahlberg.** *Food Industries*, 1929, I, No. 11, 484-486. A description (with photographs) of the Johnstown desaccharification plant. Molasses resulting from the ordinary process of beet sugar manufacture is treated in certain of the factories of the G.W.S. Co. by the Steffen lime separation process. But this process is not complete, since, besides sugar, other substances are carried down with the lime into the saccharate cake. This causes the formation of a "second molasses," the composition of which is: water, 21·96.; sucrose, 46·0; raffinose, 3·70; invert sugar, 0·40; ash, 10·87; and undetermined, 17·07 per cent. This product to the amount of 45,000 tons at least is collected from the "Gwesco" factories, and sent to the Johnstown "refinery," where it is worked up by a modification of the baryta process of DEGUIDE,[1] as developed in Belgium, a sucrose recovery of at least 75 per cent. being obtained.—BAUXITE FOR REFINING. **P. Devos.** *Bull. Assoc. Chim. Sucr.*, 1929, **46**, 292-301. In a beet sugar factory slicing 1000 tons of roots per day, if one applies 3 to 4 tons of bauxite, a decolorization of 30 per cent. in the case of the syrups can be realized, and the boiling rendement appreciably improved. This can be done simply by mixing the earth with the sulphited syrups at 70 to 80°C., and afterwards filtering through Philippes. Later the same material can be used for the molasses, and then when exhausted can be regenerated by heating in a current of air at 350 to 400°C. According to this writer, bauxite merits serious attention as a purifying agent.—EXTRACTION OF RAFFINOSE. **M. Bridel and M. Desmarest.** *Bull. Soc. Chim. Biol.*, 1928, **10**, 510-522. Following BRIDEL's rapid percolation method, the raffinose present in cotton-seed cake can be rapidly dissolved in 60 per cent. alcohol. Starting with 10 kg. of the crushed cake, this was "wetted" with 5 litres of the alcohol, then lixiviated with 10 litres, while receiving three fractions of 5 litres each, the last one being obtained by pouring 6 litres of water on the powder to expel the alcohol.

[1] *I.S.J.*, 1923, 51; 1924, 442, and elsewhere.

These operations were carried out in a working day, and 330 grms. of the pure trisaccharide were obtained, a yield said to be superior to that given by other processes.—CONDUCTIVITY APPARATUS IN BEET FACTORIES. **K. Sandera.** *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, 378-382. Using the apparatus devised by the author,[1] the values read in scale divisions for different products were as follows: diffusion water, normal 12-13; ditto, from a factory in which the waste waters were returned to process, 33-34; mixed diffusion juice, 156-164; diffusion juice from diffusion vessels Nos. 1-11, 11-151; water from the slice presses, 18-20; water from the carbonatation scum presses, 36-95; and carbonatation juice, 180.—DENATURING RAW SUGAR. **K. Sandera.** *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, No. 45, 561-567. So as to render raw sugar unsaleable as such, and suitable only for cattle feeding purposes or the like, it may be mixed with some factory waste product, as exhausted carbon, using from 0·5 to 2·0 per cent., whilst adding also some common salt, also about 2 per cent.—A SIMPLE DE-AERATING APPARATUS. **Joseph Hernych.** *Zeitsch. Zuckerind. Czecho.-slov.*, 1929, **53**, No. 35, 470-471. This does not require much description, its form being apparent from the drawing. It consists of an inverted, stout glass bottle, 11 cm. diam. × 15 cm. high, the bottom of which has been broken off, and covered with a sheet of rubber having a diam. about 13 cms. This rubber sheet is pierced with a glass T-piece, one arm leading to the source of vacuum, and the other being provided with a short piece of rubber tube and a pinch-cock, this latter being used for breaking the vacuum. After de-aeration, the juice is drawn off through the pinch-cock below, any danger of scum mixing with the juice being thus removed.



—EVAPORATOR INCRUSTATION. **O. Spengler and T. Traegel.** *Zeitsch. Zuckerind. Czecho-slov.*, 1929, **79**, 461-462. In the incrustation of the first body of the evaporator of a beet factory a great amount of phosphoric acid was found to be present. Probably this was due to the presence of phosphoric acid compounds in the juice in the form of calcium glycerophosphate,[2] this having escaped precipitation when liming was unsatisfactorily performed, but later settling out of solution on concentration.—USE OF "FIXENAL" PREPARATIONS FOR MAKING UP STANDARD SOLUTIONS. **M. van der Kreke.** *Archief*, 1929, **37**, II. No. 31, 725-726. These are solutions of reagents in sealed glass tubes, the quantity present being that required for making up a N/1, N/10 or other titre of standard solution.[3] They are intended to save time and trouble during the busy season. As to their accuracy, the following were the titres found in the case of tenth-normal solutions: sodium thiosulphate, 0·1000; potassium permanganate, 0·0998; oxalic acid, 0·1001; iodine, 0·0999; silver nitrate, 0·0996 (on washing out this ampoul it was seen some slight decomposition had occurred, the solution having a violet cloudiness); hydrochloric acid, 0·0999; sulphuric acid, 0·0998; sodium carbonate, 0·1000; sodium hydroxide, 0·1008 (methyl orange); the same (phenolphthalein), 0·1002. The tube containing the NaOH had been attacked, and gave quite a cloudy solution. Excepting, therefore, in the case of the KOH and NaOH tubes, the "Fixenal" preparations can be recommended to sugar factory chemists as sufficiently reliable.—TECHNICAL AND FINANCIAL CONDITIONS OF SUGAR PRODUCTION IN THE PHILIPPINES. **Yves Henry.**[4] *Sugar News*, 1929, **10**, No. 8, 561-572. Information is given regarding the equipment and development of the six centrals controlled by the National Bank of the Philippines, including tables showing: state of indebtedness to the National Bank of the Philippines; cost of production in pesos (6930 to 12,628 per 100 kg., for manufacturing, interest on debts, and various depreciations); transportation equipment; milling equipment;

1 *I.S.J.*, 1927, 280, 671. 2 As pointed out by STANEK: *Zeitsch. Zuckerind. Czecho-slov.*, 46, 673. 3 Already described, see *I.S.J.*, 1928, 215. 4 Inspector-General of Agriculture, Indo-China.

and chemical control results. Lastly, in the following table are grouped the figures for the average cost price of a quintal of sugar in pesos in countries controlled by the American market, according to statistics published by the Tariff Commission of the U.S.A. :—

Items of the Price	Philippines	Hawaii	Louisiana	Porto Rico	Cuba
Cost of growing	8·80	11·62	15·57	12·93	5·10
Cost of manufacturing	6·80	8·34	8·00	6·36	5·89
F.O.B. net cost	5·60	9·96	23·57	19·29	10·98
Sales expenses	2·40	2·10	0·54	1·15	1·00
Total c.i.f. New York or San Francisco	18·00	22·06	24·11	20·44	11·98
Import duty on sugar from Cuba					7·78
					19·76

PREVENTION OF CRYSTALLIZATION OF FRUIT SYRUPS. **Vl. Stanek and P. Pavlas.** *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 54, No. 3, 25-33. In Czecho-slovakia a table syrup made by dissolving sugar in a fruit juice, as raspberry, is found to grain after a time. Such syrups may contain about 33 per cent. of water, and about 65 per cent. of total sugars in widely varying proportions of sucrose and invert sugar. Granulation (generally dextrose separated out) was found to be due to the increase in the content of the invert sugar resulting from the inversion of the sucrose by the enzymes of the fruit juice, and occurred when the invert sugar rose above 50 per cent., the dry substance content being about 66 per cent. A non-crystallizing syrup could be prepared by first heating the fruit juice so as to inhibit its enzymes, the sugar later being added as usual.—EFFECT OF MEALY BUGS ON CANE MANUFACTURE IN NATAL. **C. G. Dymond.** *S. A. Sugar J.*, 1929, 13, No. 6, 339-341. The writer has collected evidence that the mealy bug is responsible to a very definite extent for the presence in the juice of a dextro-rotatory gum, together with colloidal matter of a particularly objectionable nature. Thus an ether extract of the insect had a melting point of 40-45°C., whilst a similar extract from bagasse had one of 45-47°C. Even a very small quantity of such a greasy substance would soon make itself felt at the filter-station, and it is highly probable (according to the writer) that the manufacturing troubles in the boiling house associated with juice from Uba cane are at least partly caused by the mealy bug.—WHY DO SOME RAW SUGARS CAUSE DIFFICULTIES IN REFINING? **J. J. Copyn.** *Sugar News*, 1929, 10, No. 8, 534-536. Raw cane sugars are more difficult to refine than beet sugars due firstly to the impossibility of eliminating anthocyan in the ordinary manufacturing process, this colouring persisting throughout, and secondly to the presence of wax. By a proper defecation, all the wax can be retained in the mud, so that the evaporator juice is free of it; but it may happen that the evaporator juice may be clear and yet wax be found in the raw sugar, this happening when wax is removed from the mud by steaming and returned to process with the sweet-water.—ACTIVATION OF ASH-FREE CARBONS. **Erhard Landt and K. K. Bhargava.** *Zeitsch. Ver. deut. Zuckerind.*, 1929, 79, 470-484. Ash-free carbons, prepared by heating sugar crystals to 250-300°C. were activated by heating to temperatures from 550 to 1050°C. in a current of air during 7 hours. Yields of active carbon averaging about 50 per cent. of the weight of inactive material were obtained, and such carbons were found to be as active as good commercial carbons so far as iodine adsorption was concerned, but towards molasses solutions they exhibited only a very slight activity.—CARBON ACTIVATION. **P. P. Kosakevitch and N. A. Ismailov.** *Kolloid Zeitung*, 1929, 48, 241-246. Carbon can be activated on the laboratory scale by passing superheated steam over it in a porcelain tube heated in an electric furnace. Between 700 and 800°C. the activity increases with the duration of activation and falls when the velocity of the current of steam is reduced. At 850° the activity reaches a maximum after activation for 15 mins., and subsequently falls off rapidly. If the appearance of the maximum is delayed by reducing the rate of the current of steam the maximum will be more strongly marked at 900°C.

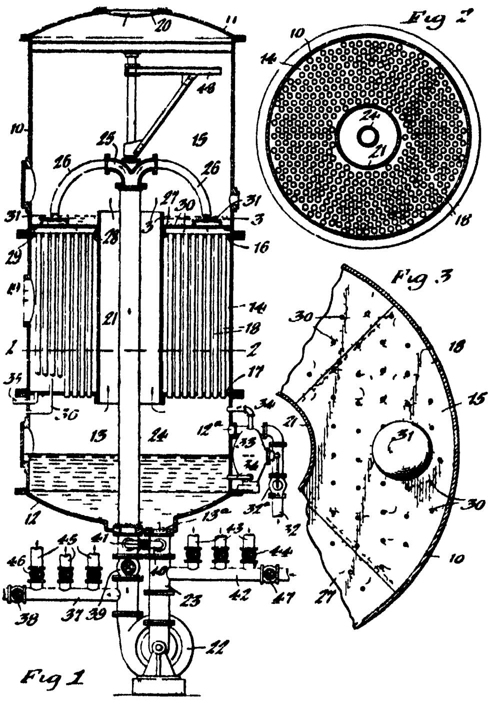
J. P. O.

Review of Recent Patents.[1]

UNITED STATES.

EVAPORATOR. **Burton S. and Stanley Hughes,** of Buffalo, New York, U.S.A. June 18th, 1929.

Objects of the invention are to provide an evaporator in which the juice (or other liquid) is free from any hydrostatic head while boiling, in which there is a large steam-disengaging surface, and in which the separation of the vapour from the boiling liquid is effective. Extending centrally through the steam compartment 14 and opening at its ends into the chambers 13 and 15 respectively, is a cylindrical shell or tube 21 which is securely connected to the tube-sheets 16, 17, to form a steam-tight joint therewith. This tube projects a suitable distance above the upper tube-sheet 16 and serves as a passage for conducting the vapours from the boiling juice upwardly into the separating chamber 15 and thence through the outlet 20 to the condenser or to the adjoining unit of a multiple effect evaporator. A centrifugal pump 22 of any suitable and well-known construction is provided for drawing the juice from the lower chamber 13, and delivering it to the upper chamber 15, from whence it flows downward by gravity through the tubes 18. This pump is preferably located beneath the evaporator-body, its inlet or suction end being connected by a pipe 23 with the juice-outlet 13^a in the lower head 12, while its outlet or discharge side is connected with a delivery pipe or conduit 24 extending upwardly through the vapour-tube 21 and into the upper chamber 15. At its upper end, the pipe 24 is provided with a distributing head 25 from which radiate a plurality of downwardly-curved branch pipes 26 for delivering the juice into the lower end of the upper chamber 15. Disposed horizontally in the latter between its bottom or upper tube sheet 16 and the outlet ends of the delivery pipes 26 is a distributing plate 27 of sheet steel or other suitable material and properly reinforced to prevent its distortion. This plate is made in three or more detachable sections, depending on the size of the evaporator, and is supported at its inner and outer edges on rings 28, 29 applied to the evaporator-body and vapour tube 21, respectively, as shown in Fig. 1. Holes or perforations 30 in this plate permit the flow of juice there-through into the steam-heated tubes 18 whose upper ends are flush with or slightly below the surface of the upper tube-sheet to insure uniform distribution of the juice to the several tubes. The holes in the distributing plate are so disposed that the falling streams of juice will impinge on the triangular spaces formed between the tubes 18 in the customary 60° tube-sheet



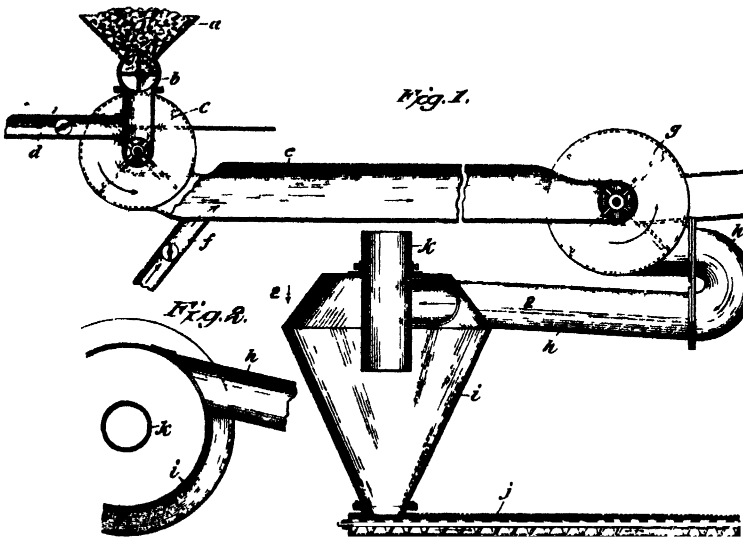
[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vielle, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

layout, thus causing the juice to spread on the top surface of the tube-sheet and flow downwardly through the tubes in a thin film adhering to the interior thereof. In practice, it has been found that adequate distribution of the juice to the tubes of ordinary size is had by providing one hole in the plate 27 for each group of 3 tubes, as shown in Fig. 3. In order to avoid violent commotion of the juice as it is discharged from the pipes 26 on to the distributing plate 27, splash plates 31 are provided. They are preferably mounted on the distributing plate above the surface thereof and opposite the discharge ends of the delivery pipes to receive the impact of the juice and to spread it laterally therefrom. Juice to be evaporated is fed to the lower chamber 15 through a supply pipe 32 connected with the inlet 12^a and containing a suitable valve 32^a. For the purpose of maintaining a constant level of juice in this evaporator-chamber, the valve is controlled by a suitable float actuated device, of any well-known construction, contained within a float chamber 33 arranged at the lower side of the evaporator and connected at its upper and lower ends by pipes 34 with the juice-chamber 13. Thus, as the juice level in the evaporator varies, the level thereof in the float-chamber is correspondingly changed and the valve 32^a is accordingly opened or closed to admit or prevent the flow of juice into the evaporator. Water resulting from the condensation of steam used for heating is discharged through a drain pipe 35 extending through the bottom tube-sheet 17, while the non-condensible gases carried in with the steam are removed through a vent pipe 36 also extending through the bottom tube-sheet and having its upper or inlet end located above said sheet to prevent the water being drained off with the gases. The juice is withdrawn from the evaporator through an outlet pipe 37 extending laterally from the lower end of the pump-discharge pipe 24 and provided with a valve 38 for regulating the flow of the concentrated juice therefrom. Arranged in the pump-discharge pipe above the juice-outlet pipe 37 is a valve 39 for regulating the flow of juice either into the evaporator or through said outlet pipe, this valve being open during the concentrating operation and closed when withdrawing the concentrated juice from the evaporator.

REVIVIFICATION OF USED KIESELGUHR. **Robt. Calvert**, of Lompoc, Cal., U.S.A. 1,717,661. June 18th, 1929.

Calcination of used kieselguhr cake presents difficulties. It contains 70 per cent. of water; it is liable to stick if an apparatus as a rotary kiln be employed; and during drying it forms lumps, preventing the conduction of heat. But in this process of revivifying, the cake is disintegrated in a stream of air of suitable temperature, so as to dry and at the same time burn up the organic matter present. As illustrated in the drawing, the filter cake *a* either as it comes from the refinery or after centrifuging to remove an additional quantity of water, is passed through a feeder *b*, designed to exclude air, to a strongly constructed, electrically driven fan *c*, operating at 1000 to 2000 r.p.m. The fan is encased in a suitable metal housing and delivers into a metal pipe line or reaction chamber *e*. Besides the wet filter cake, there is supplied through the pipe *d*, to the inlet of the fan *c*, heated air or flue gas, at such temperature and in such volume that the temperature of the fan is maintained at some temperature above the boiling point of water, say at 350°C. This temperature produces an exceeding rapid evolution of steam from the microscopic particles of disintegrated cake, and decreases whatever tendency might otherwise exist for the particles to adhere to the rapidly moving fan blades. Under some conditions, particularly with relatively dry filter cake as the raw material, sufficient heat may be supplied through *d* to raise the temperature to the point at which the organic matter is rapidly oxidized, say 500°C. It is preferable, however, to supply additional heat, as through *f*, after the filter cake has been through the disintegrating fan. For this purpose there is used also an exhauster fan *g*. This fan draws not only the dust, steam, and heated air which have passed through the first fan, but also an additional quantity of very hot flue gas which is admitted to the line at a point so as to mix with the products from the first fan, approximately at the outlet of that fan. In this way there is a completion of the drying and of the combustion in a very hot zone. This arrangement protects the first fan from handling the extremely hot gas. Further, the gases are so

cooled by the evaporation of moisture from the particles of the filter cake that the fan blades of the exhauster will not be heated to the softening temperature. At the same time, a proper regulation of feed will make possible a minimum temperature, at the entrance to the second fan, of 400°C., at which temperature the minute particles of organic matter, in intimate contact with gas containing free oxygen, are oxidized quickly. After passing the second blower, the dust is then separated from the gas, as by blowing through the pipe *h*, into the metal cyclone, *i*, (Figs. 1 and 2). The air goes out from the centre of the cyclone through the pipe *k*, and the dust at the bottom to the screw conveyor *j*, to an inclined rotary pipe cooler, to a packer, or directly to the place of re-use.



This invention is not limited to this or any type of apparatus, but only to the process of suspension of filter-cake in a stream of air or oxygen-containing gas at such a temperature and for such a time that the organic impurities are either oxidised completely or so decomposed as to be innocuous in the recovered kieselguhr. The use of water-cooled fan bearings is typical of certain engineering details which should be obvious. Also, higher temperatures than those specified may be used, in which case a shorter time of contact between the gas and the filter cake will suffice to ignite the impurities. The sizes of blowers and pipe lines will be proportioned to the tonnage per hour. To treat one ton (dry weight) of filter cake an hour, use approximately these conditions : first blower, capacity 10,000 cub. ft. air per minute ; pipe line or reaction chamber, of iron or ceramic ware, 50 ft. long × 30 ft. in diam. at its widest point ; second exhauster blower, capacity 30,000 cub. ft. air per min. ; gas temperature 400°C. in the outlet from the second fan; cyclone, of usual type, 12 ft. across at the widest point, with air discharge pipe of 3 ft. diam. leading out of the top. It may be convenient to arrange vertically the pipe line connecting the delivery of the first blower to the inlet of the second blower, in such way that any undried or heavy particles will not be blown upward and away from the drying and firing zone as quickly as the dry and lighter particles. In fact, it may be desirable in some cases to provide a vertical fire brick stack, with the one fan delivering a stream of disintegrated filter cake and hot air upward at the bottom of the stack, a furnace supplying an additional quantity of hot flue gas (at say 1100°C.) into the bottom of stack, just above the delivery from the lower fan, with a second fan exhausting the dust and gas mixture from the top of the stack and delivering to a dust separator as described above.

Maltose Products. **Frederick C. Weber and Walter H. Randall** (assignors to the **Fleischmann Co.**, of New York). 1,722,775. July 30th, 1929. A process of manufacturing maltose products, the improvement comprises diastatically saccharifying starch in the presence of yeast of the true Saccharomycetes type.—Dextrose Manufacture. **Wm. B. Newkirk** (assignor to the **International Patents Development Co.**, of Wilmington, Del., U.S.A.). 1,722,761. July 30th, 1929. A method of producing a purgible mass of crystals in a starch-converted dextrose solution comprises keeping the solution at a crystallizing supersaturation by continued extraction of water therefrom.—Beet Harvester. **Herman H. Boettcher**, of Blue Earth, Minn., U.S.A. 1,723,462. August 6th, 1929. In scooping and elevating mechanism of the class described, the combination is claimed of a rotary support, a circumferential series of trays supported thereby and having concave arcuate bottoms, a series of gathering and elevating teeth supported at the advancing side of each tray, means for automatically effecting continuous angular adjustment of the teeth in the rotation of the support to effect gathering of material from the soil and deposition of the material into the respective trays, and means for receiving the material from the trays.—Beet Loading Mechanism. **Henry A. Watkins and John C, Askwig**, of Boulder, Colo., U.S.A. 1,723, 591. August 6th, 1929. In a loading mechanism, an endless conveyor with its forward end adapted to rest upon the ground and including an endless chain, tine carrying shafts revolubly mounted on the chain, means without the chain for holding the shafts against revolution during the forward movement thereof, said holding means terminating near the forward extremity of the chain for permitting the shaft, approaching said extremity, to revolve in its mountings and permit the tines thereof to rest upon and slide forward along the ground as the shaft is carried forward by the chain, and means without the chain for preventing further revolution of the shaft and for causing the tines to rise from the ground when the shaft reaches said extremity.—Beet Lifter and Topper. **Wm. J. Godtel**, of Culbertson, of Nebr., U.S.A. 1,723,777. August 6th, 1929. A beet lifter and topper comprises a wheeled frame, a pair of oval shaped auxiliary frames carried by said wheeled frame and spaced apart in parallel vertical planes, a series of grooved pulleys rotatably mounted in each of said oval shaped auxiliary frames and arranged in pairs, spaced chains mounted for movement between the grooved pulleys, topping knives supported from the wheeled frame, and means for operating the chains and topping knives from the supporting wheels of the main frame.—Producing Clarifying Agents. **John C. Merrill, and Henry S. Montgomery**, of Pasadena, Cal., U.S.A. 1,716,828. June 11th, 1929. A method of preparing an aluminium silicate clay for use as a liquid decolorizer, includes mixing the clay with a solution of an electrolyte that does not change the chemical constitution of the clay, the proportion of a clay to solution being such as to form a plastic mixture in which all the solution is in intimate contact with the clay, the proportion of electrolyte to solvent in the solution being such that the proportion of electrolyte to clay by weight is between approximately 2 and 5 per cent.—A Process for the Clarification of Liquids. **Robert J. Marx.** 1,717,111. June 11th, 1929. A process of clarifying liquids and recovering solid matter held in suspension comprises flowing the liquid to be clarified into a comparatively small pool, flowing the liquid over the edge of the pool in a thin film to drop directly downward upon a hard surface disposed at a slight inclination to the horizontal, the thin film dividing into separate drops which fall from a height to impact upon the hard surface, which causes separation of all mechanically held air bubbles from the drops of water, flowing the thus air freed liquid into a larger pool and allowing the solid matter to settle out, and flowing the clarified liquid over the edge of the said larger pool.—Filter. **George H. Greenhalgh** (assignor to **Ernest J. Sweetland**, of Hazleton, Pa., U.S.A.). 1,721,250. July 16th, 1929. In combination, a filter having a casing composed of a plurality of similar counterpart sections having their rims attached to one another by outwardly projecting co-operating flanges, and supporting means for said filter adapted to co-operate with the flanged portions of said casing.

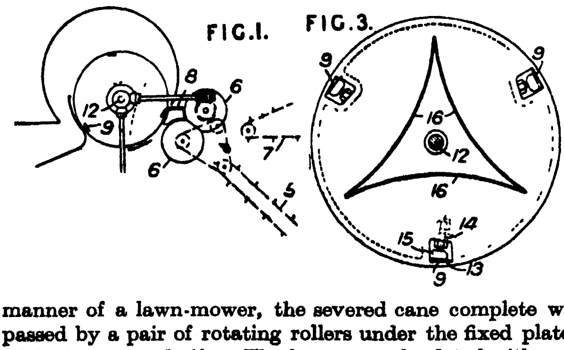
UNITED KINGDOM.

REFINING SUGAR, USING THE CARBONATATION PROCESS. **Hermann Wiese**, of Glasgow, Scotland. 314,750. November 24th, 1928.

In the process of refining raw sugar, particularly raw cane sugar, as described in the inventor's prior patent,[1] the raw sugar solution, heated to above 70°C., is mixed with 3 to 5 per cent. of lime in the form of lime cream, then carbonated until neutral, heated to above 80°C., and filtered. According to the improved process forming the subject of the present invention, the raw sugar solution heated to upwards of 70°C., say to about 73°C., is mixed with 3 to 5 per cent. lime, reckoned on the total solids, then carbonatated until neutral without the application of heat during carbonatation, and then, after carbonatation is completed, brought to a temperature of above 80°C., preferably about 100°C., by the direct injection of steam at the bottom of the tank in which carbonatation is effected, whereupon the solution is filtered, yielding a filtrate of better quality, owing to better precipitation, as also better separation of impurities and easier filtration, than was practicable heretofore. In practice, one may use for steam injection perforated steam pipes, nozzles or the like, said pipes, nozzles or the like being situated near the bottom of the carbonatation tank. Claims are : (1) In a process of refining sugar which consists in heating the raw sugar solution to a temperature above 70°C., adding lime, carbonatating to the point of neutrality, re-heating to a temperature above 80°C., and filtering, the step of injecting steam directly into the solution after carbonatation is completed and before filtration. (2) In a process as claimed in Claim 1 the use of perforated steam pipes, nozzles or the like for steam injection, said pipes or the like being situated at the bottom of the carbonatation tank.

CANE HARVESTERS. **Ralph S. Falkiner**, of Melbourne, Australia. 314,415 ; divided on 314,364. March 26th, 1928.

In a cane harvesting machine of the type described in specifications 251,739[2] and 284,683,[3] the cut cane together with its tops and attendant trash is delivered, for example by a conveyor or the like, to feeding means, which may be a pair of rollers, which grip it and pass it to a rotary cutter whereby the cane, tops and trash are all chaffed or cut up into small pieces. The separation of the chaffed trash may be effected by air blast arrangements of the kind described in the aforesaid specifications and the cut pieces of cane thrown out by the rotary cutter may be directed to the desired point of discharge by suitable baffling arrangements. The cutting of the trash into chaff or small pieces facilitates the handling of same in any manner required. For example, it may be ploughed into the ground or put into wind rows. This cutting up of the cane into small pieces facilitates the bulk handling and the first processes of milling. In carrying out the invention the cutting mechanism may comprise a rotating knife co-operating with a fixed plate or blade after the manner of a lawn-mower, the severed cane complete with its tops and trash being passed by a pair of rotating rollers under the fixed plate or blade into engagement with the rotary knife. The latter may be fitted with a deflector plate to cause the pieces of cut cane and trash to be ejected upwardly as hereinafter described.



1 U.K. Patent, 12,642 of 1911. See also *I.S.J.*, 1929, 339.
2 *I.S.J.*, 1926, 499. 3 *I.S.J.*, 1928, 337.

Referring to the illustrations, the cut cane falls on to a conveyor 5 that carries it to a pair of rotating rollers 6, these rollers preferably being provided with pneumatic or resilient tyres. A second moving belt 7 assists in directing the cane between the rollers. The rollers 6 feed the cane below a ledger blade 8 provided with guiding side plates and into the path of knives 9 carried between two discs mounted on a rotating shaft 12. The cane, tops and trash are all chaffed or cut up into small pieces. The knives 9 are held on seats 13 by bolts 14 bearing on clamping pieces 15. A deflector comprising three curved plates 16 is mounted on the shaft 12 and engages and ejects the pieces of cane cut off by the knives 9. Air blast arrangements as described in Specifications 251,739 and 284,683 may be employed if desired to separate the cut chaff or trash from the cut cane. In a modification the cane is cut while held between two pairs of rollers by rotary knives acting at right-angles to the path of the cane. Fan blades may be fitted to these knives.

PREPARATION OF SUGAR SOLUTIONS FROM THE MANIHOT PLANT. **E. J. Cross**, of Lincoln's Inn, London. 311,979. July 7th, 1928. A sugar solution suitable for the manufacture of yeast as well as for other purposes is obtained by acid saccharification of the solid constituents of roots of the manihot plant from which a substantial proportion of the constituents of the amniotic fluid of said roots has been removed. The roots are washed, pressed, dried, mixed with dilute acid and heated. The solution may be neutralized with ammonia if it is to be used for the production of yeast or alcohol, or glucose may be obtained therefrom.—BLEACHING SYRUP BY GASES. **N. V. Internationale Oxygenium Mij. Novadel**, of Deventer, Holland. 312,075. May 15th, 1929; convention date, May 19th, 1928. A gas to be used for bleaching, deodorizing, and disinfecting materials such as fabrics, grain, flour and other milling products, sugar, syrup, tobacco and straw is obtained by bringing air, carbon dioxide, oxygen, or other gas or gas mixture into contact with a mixture of one or more persalts and one or more halogen acids or their salts. The salts of the halogen acids may if desired be employed in acid solution. Persulphates, perborates and alkali chlorides or bromides or mixtures thereof may be used. Catalysts, more especially the alkali salts of strong mineral acids, may be employed in the reaction which is effected at ordinary or increased temperature. In an example, flour is treated with the gas obtained by passing air through a mixture of ammonium persulphate and hydrochloric acid at 46-50°C. In a further example, sugar syrup is treated with the gas obtained by passing air through the liquid prepared by mixing potassium persulphate with strong sulphuric acid and then adding ammonium chloride solution, the proportions used being given in the specification.—CLEANING BAG FILTERS. **Amme-Luther Werke Braunschweig A.-G.**, of Braunschweig, Germany. 313,087. June 4th, 1929; convention, June 6th, 1928. Apparatus for shaking bag filters, etc. comprises a pair of shafts rotating at slightly different speeds and carrying one or more pairs of co-acting cams which periodically engage a head pivoted to a rod and lift the rod with bags suspended thereon in chambers. One of the cams of each pair may have a number of teeth, so that at each periodic co-action of the pair of cams, a number of successive movements may be given to the rod.—CLARIFICATION OF CELLULOSE HYDROLYSIS PRODUCTS. **International Sugar & Alcohol Co., Ltd.** 313,258. April 14th, 1928. Cellulose hydrolysis products, particularly those resulting from the conversion of cellulose into sugar by the use of hydrochloric acid as hydrolysing agent, are clarified by subjecting to electrolytic treatment. Low potentials of 2-3 volts are employed, and the nascent chlorine liberated acts to render the impurities insoluble. In order to prevent frothing, a pórous diaphragm or partition may be employed to isolate a cathode space containing hydrochloric acid or a dilute sugar solution having a hydrochloric acid concentration corresponding to that of the hydrolysis product under treatment. Acheson graphite electrodes can be used. The sugar solution is allowed to flow continuously into the anode space.—SUGAR EXTRACTION AND PULP PRODUCTION FOR PAPER MAKING. **H. G. C. Fairweather** (communicated by **Vascane Process, Inc.**, of Wilmington, Delaware, U.S.A.). 314,174. May 4th, 1928. Cane is ground or abraided into individual fibres or aggregates or relatively few fibres for the removal of sugar in the presence of a liquid, the pulp

obtained being suitable for paper making.[1]—RECOVERY OF SUGAR FROM BEET CARBONATATION SCUMS.[2] **H. Claassen.** 296,985. August 24th, 1928. Press cake, containing 0·75 to 1·0 per cent. of sugar, is mashed with hot water to a paste of about 18 to 25° Brix, which is heated to about 80°C., and sent through filter-presses or decanters for the separation of the liquid and solid constituents. A decanting apparatus generally suffices, since the juice containing the sugar does not require to be clear. It is utilized for sweetening off the filter-presses, or otherwise returned to a suitable part of the process.—CELLULOSE SACCHARIFICATION. **Holzhydrolyse A.-G.** (assignees of **F. Bergius**, of Heidelberg, Germany). 315,198. July 8th, 1929; convention date, July 7th, 1928. Wood sugar formed by the hydrolysis of wood and other substances containing cellulose with hydrochloric acid, is purified from hydrochloric acid by treating the loose crude product, obtained by drying in the atomized condition, with organic solvents, causing it to sinter by gentle heating and separating the solvent by decantation or by the addition of a small amount of water. The solvent used may be alcohol and benzene, and if chlorides are also present in the dry sugar, chlorine ions may be removed by adding fairly concentrated sulphuric acid to the solvent.—PREVENTING AND REMOVING BOILER SCALE. **J. Y. Johnson** (**I. G. Farbenindustrie A.-G.**, of Frankfort-on-Main, Germany). 315,287. April 10th, 1928. Incrustation on heating and cooling surfaces is prevented by treating the water with humates, particularly those of alkali metals, or with substances which are rich in humic acid and have been treated with alkalies or salts with an alkaline reaction. The humates may be prepared from humus coal, brown coal, peat, bog earth, forest humus, etc., or artificial humic substances prepared from lignin, cellulose, phenols, proteids, sugars, or furane derivatives, by treatment with alkalies or substances with an alkaline reaction.

Sugar Production in Europe.

In Raw Value.

(*Licht's Estimate at September 30th*, 1929).

	1929-30 First estimate 30-9-29. Tons.	1928-29. Tons.	1927-28. Tons.
Germany	1,700,000	1,851,263	1,664,412
Czecho-Slovakia	1,025,000	1,042,948	1,239,155
Austria	120,000	107,322	110,004
Hungary	230,000	220,062	186,701
France	910,000	903,075	863,206
Belgium	260,000	279,290	273,113
Holland	260,000	319,937	259,964
Denmark	135,000	170,000	142,800
Sweden	105,000	160,860	145,335
Poland	780,000	756,889	566,961
Italy	415,000	367,334	284,276
Spain	255,000	262,000	236,162
Dantzig	30,000	30,000	27,580
Yugoslavia	135,000	129,000	83,600
Roumania	80,000	130,000	139,522
Bulgaria	35,000	29,870	42,977
Switzerland	6,000	7,000	6,550
England, Scotland, Wales	290,000	222,590	217,233
Ireland	20,000	22,500	20,500
Finland	3,000	3,387	5,959
Latvia	4,000	2,000	2,000
Turkey	6,000	4,000	6,000
Europe without Russia	6,804,000	7,021,327	6,524,010
Russia	1,350,000	1,446,000	1,501,986
Europe including Russia	8,154,000	8,467,327	8,025,996

[1] See U.S. Patent, 1,688,905; *I.S.J.*, 1929, 227. [2] Also German Patent 476,715.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending September 30th. 1928. Tons.	1929. Tons.	Nine Months ending September 30th 1928. Tons.	1929. Tons.
Unrefined Sugars.				
Poland	....	147	550	56,653
Germany	....	1	460	33,701
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	2,567	....	20,986	20,074
Java	100	19,099	4,091	145,213
Philippine Islands	....	....	....	....
Cuba	70,171	114,621	524,229	603,920
Dutch Guiana	....	....	....	....
Hayti and San Domingo	10,420	18,523	204,618	183,913
Mexico	....	....	....	....
Peru	10,129	9,332	63,428	85,642
Brazil	1,135	....	15,074	11,637
Union of South Africa	15,114	11,861	31,348	46,473
Mauritius	1	403	125,704	168,660
Australia	7,047	12,284	75,412	117,669
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	7,462	337	128,933	87,488
Other Countries	3,658	4,025	51,982	33,739
Total Raw Sugars	**127,803**	**190,634**	**1,246,817**	**1,594,781**
Refined Sugars.				
Poland	....	....	3,334	....
Germany	20	13	1,022	768
Netherlands	2,270	481	81,114	12,173
Belgium	102	45	3,381	876
France	....	....	....	....
Czecho-Slovakia	1,982	755	88,243	20,871
Java	....	....	....	....
United States of America	602	683	12,290	7,980
Canada	1	....	6,137	8
Other Countries	7	12	3,065	87
Total Refined Sugars	**4,984**	**1,990**	**198,587**	**42,763**
Molasses	1,989	6,621	188,999	175,916
Total Imports	**134,776**	**199,245**	**1,634,403**	**1,813,460**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons	Tons.
Denmark	68	57	797	754
Netherlands	17	24	303	228
Irish Free State	3,620	3,601	34,969	36,925
Channel Islands	74	67	1,161	888
Canada	....	....	....	....
Other Countries	3,463	3,772	11,224	76,295
	7,241	7,521	48,454	115,090
Foreign & Colonial Sugars.				
Refined and Candy	534	311	4,233	1,785
Unrefined	148	34	747	583
Various Mixed in Bond	....	....	....	....
Molasses	36	2,436	3,521	8,325
Total Exports	**7,959**	**10,302**	**56,955**	**125,783**

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons.		1928. Tons.
Total Receipts, Jan. 1st to September 28th	2,850,747	..	2,369,639
Deliveries „ „	2,501,440	..	2,230,782
Meltings by Refiners „ „	2,357,416	..	2,130,615
Exports of Refined „ „	74,000	..	73,289
Importers' Stocks, September 28th	447,538	..	247,397
Total Stocks, September 28th	656,286	..	343,125
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT AUGUST 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	3,032,457	..	2,511,169	..	3,718,038
Stocks	783,717	..	828,391	..	739,068
	3,816,174		3,339,560	..	4,457,106
Local Consumption..	96,000	..	55,806	..	74,379
Receipts at Ports to August 31st ..	3,912,174	..	3,395,366	..	4,531,485

Habana, August 31st, 1929. J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR NINE MONTHS ENDING SEPTEMBER 30TH, 1927, 1928, AND 1929.

IMPORTS.	1927. Tons.		1928. Tons.		1929. Tons.
Refined......	372,309	..	198,587	..	42,763
Raw	865,711	..	1,246,817	..	1,594,781
Molasses ..	110,094		188,999	..	175,916
	1,348,114		1,634,403		1,813,460

EXPORTS (Foreign).	1927. Tons.		1928 Tons.		1929. Tons.
Refined	3,830	..	4,233	..	1,785
Raw..	1,819	..	747	..	583
Molasses	232	..	3,521	..	8,325
	5,881		8,501		10,693

HOME CONSUMPTION OF IMPORTED SUGAR.

	1927. Tons.		1928. Tons.		1929. Tons.
Refined	417,422	.	200,330	..	43,304
*Refined (in Bond) in the United Kingdom	651,390	..	333,491	..	1,888
†Raw	106,171		843,744	..	1,541,594
Total of Sugar	1,174,982		1,377,565		1,586,785
Molasses	4,659	.	5,390	.	7,072
Molasses, manufactured (in Bond) in United Kingdom ..	67,327	.	31,236	..	2
	1,246,968		1,414,191		1,593,859

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT SEPTEMBER 30TH.

	1927. Tons.		1928. Tons.		1929. Tons.
Manufactured from Home Grown Beet	250	..	1,600	..	3,900
Refined in Bond	66,300	.	21,450	..	3,250
Foreign Refined	34,750	..	12,650	..	8,850
„ Unrefined	147,250	..	115,500	..	162,950
	248,550		151,200		178,950

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 146,773 tons entered for refining in refineries in the month ended 30th September, 1929, and 1,429,669 tons in the nine months ended 30th September, 1929.

United Kingdom Monthly Sugar Report.

Our last report was dated 16th September, 1929.

A period of firmness has prevailed in the market during the last few weeks and sentiment shows distinct signs of changing in favour of the article.

The single selling agency in Cuba which came definitely into force last month has proved itself to be a very formidable holder. For the present the Syndicate refuses to sell under 2⅜ c.i.f. New York, and although this price has not yet been reached it looks more than likely that eventually it will have to be paid.

With regard to the Brussels Conference, although there have been rumours of further meetings, nothing definite or official is known as yet.

There has been a fair business done in the London Raw Terminal Market, and prices have been advanced most of the time.

December sold from 8s. 9d. to 9s. 3¾d. to 8s. 11¼d., March from 9s. to 9s. 7½d. to 9s. 3d., May from 9s. 4½d. to 10s. 2¼d. to 9s. 9d., August from 9s. 9d. to 10s. 6¾d. to 10s. 0¾d. December, 1930, has been recently quoted and sold down from 10s. 6d. to 10s. 1½d.

In the White section business has been strictly limited. December sold from 11s. 1½d. to 11s. 9d. to 11s. 6d., March from 11s. 7½d. to 12s. 3d. to 12s., May from 12s. 6d. to 12s. 4½d., August from 12s. 3¾d. to 12s. 11¼d. to 12s. 7½d.

There has been a fair trade in actual sugar, chiefly confined to British Refined and Home Grown. Refiners' prices were advanced 3d. on September 27th and their latest prices are No. 1 Cubes 27s. 9d., London Granulated 24s. 4½d. The prices of Home Grown to-day are from 23s. to 23s. 6d. on the spot according to factory.

Raw sugars have not been plentiful and our refiners have obstinately refrained from buying any quantity. Small parcels have been traded in from 8s. 9d. to 9s. 4½d. c.i.f. and some Perus were sold on 9th near at hand at 9s. 1½d. c.i.f. The first hand price of Cubans still remains in the neighbourhood of 10s. c.i.f.

F. O. Licht issued at the end of September his usual estimate of the European beet crop, his figure being 8,154,000, against Dr. Mikusch's estimate of 8,575,000 tons. Last year's out-turn was 8,467,000 tons.

Arthur B. Hodge,

Sugar Merchants and Brokers.

21, Mincing Lan e,

London, E.C.3.

10th October, 1929.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 371. NOVEMBER, 1929. VOL. XXXI.

Notes and Comments.

The Outlook.

Expectancy, it may be said, still rules the sugar market. Of late there has been some hardening of prices, but it has not been sustained, in part possibly because Cuba has let a large parcel go to Europe at a price under 2 cents. This is of course old-crop sugar, and the real tussle in which the Cuban Single Seller proposes to engage will not commence till new crop sugars enter the market. The two bull points as to which the market awaits developments are, first, the outcome of this Cuban mode of marketing; secondly, whether Java will agree in the end to join Cuba and others in a policy of crop restriction. Meantime, the Wall Street *débâcle* has had a bearish effect for the moment.

As regards the first point, there seems little doubt that the Cuban Single Selling Agency means business, and in the course of its preliminary canter since June has given evidence that the scheme may work. Our Cuban Correspondent last month was disposed to think it would prove a success. At home, one of the leading market circulars, that of Mr. GOLODETZ, has been analysing the situation with some lucidity. According to him, Cuba is in possession of 50 per cent. of the world non-protected surpluses of sugar. With some 400,000 tons of old crop sugar and the whole of the new-crop one of some 4½ millions, she is too strongly entrenched to be underbid with any effect. So long as (in the past) Cuba had to throw on the market within a few months the consuming requirements of a year, she was liable to severe competition from other free market sources, and the American refiners were not slow to take advantage of this fact to get the sugar at a price which made the 44-point preference rather illusory. But now the Single Selling Agency proposes to handle the whole production, and to ration it to the market (if it can) at a price that will show some profit. As to the argument that other producers may take advantage of this selling reserve to fill the market needs from their own production, it is answered that Cuba holds too large a share of the world surplus for such competition to last long, and she may be able to bide her time while it is attempted.

It looks as though Cuba's plan is to work to secure the full American preference; and if, in the course of doing so, the situation becomes tight, she

will ease it by selling a parcel to Europe on more favourable terms. This at any rate is the policy indicated by recent happenings, for Cuba has sold only small lots of old-crop sugar to the States at over 2 cents, whereas to England she let go a parcel of 50,000 tons at 9s. 4½d. c.i.f., equal to 1·85 cents, f.o.b. Cuba. She has in fact established a 25-point difference on actual sales, though till she sells a similar large parcel to New York, any exact comparison is hardly possible. Be this as it may, the indications seem all in favour of Cuba's improving the market, provided she refrains from forcing sales and is content with moderate profits.

* * * *

As regards Java's attitude, it would appear that negotiations are still being undertaken, though little or no information is allowed to leak out. But from remarks that have been dropped by responsible parties in Holland, it looks as though a more optimistic feeling is in existence that a successful issue will yet be secured. It may be noted that the Dutch rubber producers who held aloof from the British Stevenson rubber restriction scheme and thereby very greatly reduced its effectiveness, are on their part, now that rubber is proving so little remunerative, angling for restrictive marketing measures in conjunction with British producers. There seems no reason why their confrères in the sugar industry should not similarly conclude that the time is ripe to drop pure individualism and combine with the world's largest sugar producer to regulate production in terms of a reasonable profit.

We should have thought that Java really stood to gain more than Cuba in the long run by a regulation of production, because Java cannot look to any increase of crop by additional acreage, but must depend on the slower and less certain expedient of evolving yet more productive cane varieties, and on a further improvement in her very high standard of efficiency. Cuba, on the other hand, is only on the threshold of intensive and scientific production. Her recently formed Association of Sugar Technologists have yet to reap their ultimate reward. The Cuban canefields have still to reflect the uses of the modern high yielding canes of the Java type. In short, the greater part of that which has made the Java sugar industry what it is has yet to receive full application in Cuba. Moreover, Cuba has still a considerable amount of virgin soil that may eventually be brought into use, whereas Java has not. Taking all these facts into consideration it is not difficult to postulate that in a bout of unrestricted competition Cuba can much more readily achieve an output of seven million tons of sugar than Java can half that amount. To allow that combined quantity to enter the world's market in advance of the world's ability to consume it would merely accentuate the present troubles of the sugar industry, and would spell ruin to every producer that was not in possession of an adequately protected market. Would the Java producers be better off in pocket as a result of such a competitive policy than they would be if they agreed to assist in co-ordinating Production to Consumption? It is difficult to believe so.

A Suggested New International Sugar Convention.

Dr. PRINSEN GEERLIGS, who as one of the expert advisers of the Economic Committee on Sugar of the League of Nations has been making a detailed study of the sugar situation, comes forward in an article in the Amsterdam *Telegraaf* with a proposal for the conclusion of a new sugar convention between Governments of countries interested in sugar to replace the long defunct Brussels Convention of 1902.

He argues that agreements amongst producers have no legal binding and in case of evasion the defaulting parties could hardly be brought to book. He is dubious, and possibly rightly so, of proposals to increase consumption by propaganda, on the grounds that those who can afford sugar and eat all they feel inclined to, are not likely to increase their consumption still further merely at the bidding of advertisement, while those who cannot afford the high price of taxed sugar are not in a position to buy more. The remedy, as he sees it, is for the Governments to agree by Convention to restrict their excise duties on sugar to a certain moderate figure and their import duties to a reasonable excess over the excise. The details of this proposal are given on another page. The natural result, he argues, would be that the poorer sections of a community would be able to raise their quota more nearly to that of their wealthier neighbours, because the retail price of the sugar would be lowered once excess taxation was curtailed by international agreement. Thereby consumption would increase and catch up production.

It seems to us that this is only one end of the stick, even if it be the handle end. If production is left to pursue its own unrestricted way, what guarantee have we that it will not once more outrun the admittedly augmented consumption ? And having regard to the history of the tedious and protracted negotiations that eventually led to the signing of the 1902 Convention one is doubtful of any possibility of international agreement being arrived at with any promptness. More likely it would need some years of painstaking negotiation and tactful pressure to get all concerned to abandon their multifarious levels of taxation for one common basis. It may be worth trying ; but in the meantime we question whether it would not be as well for the leading producers to get on with the task of seeking a solution of their own. With a single seller in Cuba and practically a single agency in Java, the risks of evasion of an agreement do not seem so outstanding, and these two with their production of nearly a third of the world's output of sugar could exercise a very appreciable influence on the course of the world market. If at a later stage the various Governments arrived at an agreement to lighten the fiscal burdens of the consumer, so much the better for consumption, and production would then be adjusted accordingly. But if production remains unrestricted, we may easily again fall into the same morass as we are in now, with the mere difference that the figures of production and consumption will be a few million tons higher than at the present day.

Revival of the Liverpool "Futures" Market.

There was a small " futures " market in existence in Liverpool at the beginning of the century but this was suspended during the War and was not renewed. Now however, under the lead of Mr. J. Leslie Fairrie, the Liverpool refiner, it is to be revived on the lines of the New York Coffee and Sugar Clearing Association for carrying on dealings in the main contract confined to non-preferential cane and Continental beet 88° delivered ex store Liverpool. The method of storing sugar in Liverpool is said to be cheaper and more elastic than in London, and the forms of contract to be put into use in Liverpool are claimed to be more adaptable to the requirements of would-be operators and a varying category of buyers. Liverpool at present is capable of refining some 750,000 tons of sugar per annum, and she is the natural port for importations of Peruvian and Brazilian sugars. Of late years she has had to depend on the London Terminal market for dealings, but it is claimed that London is losing its position as a great market, as it now fails to afford

the facilities for hedging that are needed; such business goes increasingly to New York or Hamburg, the latter of which has taken half a million tons from London this year. The London Terminal Market is naturally strongly opposed to the new scheme, on the grounds that there is no real need for a separate market at Liverpool and that what business it obtains will only be at London's expense: it has therefore gone to the length of urging its members by resolution to boycott the Liverpool market.

All the same, Liverpool is starting in the new year under sufficiently strong auspices to favour its chances. The Liverpool refiners, including of course TATE & LYLE, are behind the venture, while one or two London brokers, including Mr. F. GOLODETZ, have joined, and applications for membership are coming in satisfactorily. Two new companies have been formed to run the scheme: one, called the Liverpool Sugar Association Ltd., will control the market, while the other, the Liverpool General Produce & Sugar Clearing House Ltd., will put through the contracts. The Liverpool interests deny that their new market will necessarily adversely affect London. The combined markets of London and New York, it is pointed out, have so far secured an annual volume of terminal business equal to approximately 50 per cent. of the total world's sugar supply; as a contrast, in cotton and wheat futures exchanges the world's output is turned over many times a year. In sugar markets hedging business is a comparatively new feature and the prospects for the further development of such terminal business are claimed to be considerable. So it is more probable in the end that Liverpool's market will tend to encourage dealings and not merely operate at the expense of London.

Producing under Difficulties in the West Indies.

The annual report of the St. Madeleine Sugar Company Ltd., for the year ending June 30th last shows a surplus on the profit and loss account of £1142 (as against £56,389) which with a sum of £8407 brought forward from the previous account, less £4003 reserved for income tax, leaves a net balance of £5546, which sum is carried forward. This meagre return is entirely due to the Company having to face the worst sugar markets they have known for 15 years past, and not to field or factory results which were above the average. These results show that owing to the richness of the juice only 8·45 tons of cane were needed to make a ton of sugar, a figure that compares with an average of 9·7 tons during the six previous seasons. The amount of sugar made constitutes a record, at 32,071 tons, which compares with 19,434 tons in 1927 and 13,739 tons in 1923. On the other hand, the average price obtained for the sugar per ton, f.o.b., was only £12. 1s. 10d., which compares with £15. 3s. 1d. in 1928, £18. 2s. 0d. in 1927, and over £24 in 1923 and 1924. The purity of the juice was 83·91, compared with 82·44 in 1928 and 79·90 in 1927.

Mr. G. MOODY STUART (the Chairman), in his address at the annual meeting, remarked that in ordinary circumstances the factory would have made a good profit, but in view of the bad sugar markets experienced for so long, it was a matter for thankfulness that the balance had come out on the right side. He emphasized however, that but for the Empire preference of £3. 15s. 0d. per ton, the price obtained for the sugar would have been no more than £8. 6s. 10d., which figure would have spelt ruin for the Company. He quoted the opinion of Dr. MIKUSCH that the present crisis in the sugar world is the result of the network of protective duties creating and maintaining sugar production where it could never survive on equal terms of competition against

producers more favoured by nature. The leading European nations and the United States gave their peoples and their colonies protection to the extent of more than £10 per ton. He felt sure that the West Indian Sugar Commission now investigating would find that St. Madeleine was as efficient as it could be made, and that for the Government it was not a matter of introducing improvements but of refraining at this juncture from withdrawing the sugar preference which alone saves the West Indian sugar industry from being ruined.

Mr. MOODY STUART went on to urge that the Government instead of touching the preference should set themselves to the task of getting all protection in sugar abolished in Europe and the U.S.A.; if they were successful in that, the West Indian sugar industry would revert to a sound basis. If once the production of sugar at uneconomic rates were to cease, the world price of sugar would rise to its proper level. On the other hand, he pointed out that so long as West Indian producers were kept in a position of uncertainty as to whether or not Mr. SNOWDEN was going to cancel the sugar preference next year, it was difficult for them to plan the marketing of their 1930 crop.

Sugar Refining in Canada.

The High Commissioner of Canada in London has received from the Dominion Bureau of Statistics at Ottawa a Report giving figures for 1928 for the sugar refining industry in Canada. The number of refineries reporting operations during the year was 8, located as follows: Ontario 2 (Chatham and Wallaceburg); Quebec 2 (both at Montreal); New Brunswick 1 (Saint John); Nova Scotia 1 (Dartmouth); Alberta 1 (Raymond); and British Columbia 1 (Vancouver). The total capital investment in the industry was $48,625,818, employees numbering 2381, whose wages and salaries aggregated $3,671,086. The refineries purchased materials valued at $40,551,874, producing sugar and syrup, etc., worth $52,085,155, the value added by manufacture being $11,533,281.

The material used in the refineries consisted predominantly of raw cane sugar, valued at $35,321,769, imported from Fiji, British Guiana, Cuba, Barbados, and from Jamaica and other West Indian colonies, the quantity used totalling 451,418 short tons during the year. The tonnage of sugar beets used was 244,930, valued at $2,041,465.

The acreage of sugar beets in Canada in 1928 was 34,323, slightly under the record reached in 1925. The yield per acre was 7·14 tons, representing a total yield of 244,930 tons, with an average price per ton of $8·33. From these beets there was a production of 32,326 short tons of sugar, the average value being 5·17 cents a lb.

The production of sugar of all kinds in Canada in 1928 totalled 463,808 short tons, which included 382,599 tons of granulated cane sugar; 32,327 tons of granulated beet sugar; and 48,883 tons of soft cane sugar. Canada's sugar consumption during the year is calculated at 462,755 short tons.

WOOD SUGAR.—In a factory in Stettin, Germany, sugar is being prepared from wood on a large scale very cheaply by the Bergius process,[1] using concentrated hydrochloric acid. This wood sugar is mixed with substances which contain a fair amount of protein to give a fodder for sale to farmers. In the Scholler process, the hydrolysis of the cellulose of waste woods is carried out under pressure with very dilute sulphuric acid, the fermentable sugars obtained being converted to alcohol.

1 *Centr. Zuckerind.*, 1929, 37, 928.

A Suggested New International Sugar Convention.

Dr. H. C. Prinsen Geerligs Drafts a Scheme.

Dr. H. C. Prinsen Geerligs has recently published two articles, in which he suggests the feasibility of concluding a new Sugar Convention, as a means of solving the present abnormal situation in the industry. The first of these articles was published in *De Telegraaf* of Amsterdam, on September 28th, and gave some general considerations of the scheme ; the second, which appeared in the *Journal des Fabricants de Sucre* of October 5th, submitted a complete draft for such a Convention. We give below a summary of the first mentioned paper, of which an English translation has been circulated by the League of Nations for the information of the members of its Economic Committee (*E/Sugar/*42).

Dr. Geerligs remarks at the outset that there is general agreement that the present situation is the outcome of a disproportion between production and consumption that has become increasingly acute. Any method of improving the situation must therefore consist in reducing output or increasing consumption, or both. But opinion is divided as to the best method to adopt. Dr. Geerligs himself is dubious as to the feasibility of trying to increase consumption by advertisement propaganda. All those who have the means to buy sugar already, in his opinion, consume as much as they need ; those who cannot afford it will not buy just because they are pressed by advertisement to do so. The only practical means of bringing about an appreciable increase in consumption would be to make a big reduction in consumption taxes on sugar. By thus lowering the price, the less well-to-do classes would be enabled to use more sugar and so increase the total consumption. Thus we see that the present position is partly the outcome of fiscal measures taken by Governments themselves, and it is to these Governments that we must look for any alleviation of the consumption taxes.

There remains consideration of the question of limiting Production or Exports. Of late months a number of conferences have been held between leading representatives of the sugar industry with such an aim in view. Negotiations between representatives of a number of exporting countries are still proceeding, and we note that Dr. Geerligs inclines to the view that these "will probably lead to practical results." But he points out that it will be difficult to bring about any such agreements on international lines if the negotiators have no official powers to compel observance and check evasion amongst the sugar manufacturers professing to co-operate ; they would have no means of imposing penalties and might be disavowed by their own Governments. Hence it is advisable that any international agreement should be concluded between Government representatives, as was the case at the Brussels Convention of 1902, and preferably with the co-operation of a larger number of interested sugar producing and consuming parties. Any return to the 1902 Convention is now of course impossible, as too much has happened in the world since then, and circumstances have greatly changed. But something new might well be attempted.

Although the present situation is not very easy of regulation, it is not disquieting, in Dr. Geerligs' view. Provided there be a cessation of drastic Government regulations dealing with sugar, consumption which is on the increase should shortly overtake production and allow a satisfactory balance to be attained. But to ensure this proviso some form of international convention needs concluding between the Governments concerned ; and Dr.

GEERLIGS proceeds to sketch a scheme of agreement which he considers should have some chance of success. According to him, this Convention should be on the following lines :—

(1) All overt or concealed bounties on the production or export of sugar to be abolished. (Great Britain, being bound by its legislation on this subject until 1933, would be allowed a respite until the end of the period for which these obligations were undertaken).

(2) The Governments to undertake not to restrict the consumption of sugar by excessive consumption-taxes. For five years after the date of the entry into force of the convention they would not impose any higher tax than 30 gold francs per 100 kg. (the exact amount to be brought to the next higher integer) for sugar having a content of 100 per cent., and correspondingly lower amounts for sugar of lower content.

(3) Countries under a single Government to form one unit, which would regulate relations between its various parts independently of the convention. (E.g., the British Empire would form one unit; the United States, with Hawaii, Porto Rico, the Virgin Islands, and the Philippines, would form another ; the Netherlands, with the Dutch East Indies and Surinam, would be a third ; then there would be France and her colonies ; Japan with Formosa, etc.).

(4) No import duties exceeding the excise duties on home manufactured sugar by more than 20 gold francs per 100 kg. of white or 15 gold francs per 100 kg. of raw sugar, to be levied on imports into the territory of one group from that of another.

(The surtax of 6 francs per 100 kg. on white sugar, or 5·50 francs per 100 kg. on raw sugar, provided for under the Brussels Convention, is thus increased to 20 and 15 francs respectively. In this way it would be possible to protect both the home production and the refining of sugar).

(5) The parties to the convention to accord the same treatment to each other's sugar imports, without granting any preference to individual parties. (the members of a single group, e.g., the British Dominions and Great Britain would not be required to comply with this rule, which would only apply to trade between different groups).

In the case of Cuba and the United States, which have concluded a reciprocity agreement whereby they allow each other reductions on import duties, the difference of 20 per cent. would be allowed to remain, but could not be increased.

(6) The parties to the convention to be entirely free to import sugar from countries not acceding to the convention, provided that the conditions allowed were in no case whatever more favourable than those granted to acceding countries.

(7) The supervision of the execution of the convention, and the treatment of any differences or questions that might arise, to be entrusted to a permanent commission on the same lines as that created by the Brussels Convention.

QUEENSLAND DEVELOPMENTS.—Mr. L. D. Larsen, Manager, Kilanea plantation, T.H., has made a tour of Queensland districts, finding the following developments[1] : the general practice of machine planting ; new and original implements for inter-row cultivation ; the use of machine for applying fertilizers ; the use of machines for weeding in the cane row ; and the endeavours made to perfect harvesting machines. In the use of fertilizers Queensland seems to be rather backward, but this may be due in part at least to the general practice of fallowing and green manuring, which to a large extent takes the place of fertilizing.

1 *Aust. S.J.*, 1929, 21, No. 5, 277-279.

A Proposed Change in Milling Control Calculations in Cuba.

By EARL L. SYMES.

Cuba has become known as the home of low fibre cane. Many technologists consider the production of cane with a 10 per cent. fibre content as a peculiar characteristic of our soil and climate. Dr. FRANCIS MAXWELL states in his recent book "Economic Aspects of Cane Sugar Production" (page 46) "Cuba produces canes which have comparatively a very low fibre content, the average for some sixty factories, according to the report of the Cuba Sugar Club for the season 1926, being 10·3 per cent." Other similar remarks might be cited, but this is a fair example of the idea held by many cane sugar men. I believe that the low fibre content of cane in Cuba is a characteristic of our methods of calculation and not due to natural conditions of cane variety or soil, and that the true fibre is nearer 12 per cent. than it is to 10 per cent. on cane.

The following table will show how the fibre per cent. cane has varied during the past five years in Cuba, Java and Hawaii.

FIBRE PER CENT. CANE.

Country	Year 1924	1925	1926	1927	1928	1929	5-year Average
Cuba	—	10·48	10·39	10·45	10·63	10·56	10·50
Java	12·90	12·80	12·80	12·70	12·70	—	12·78
Hawaii	12·74	12·74	12·65	12·49	12·50	—	12·62

This indicates an average fibre for Cuba of 10·50 per cent. on cane, as compared to 12·78 per cent. for Java and 12·62 per cent. for Hawaii over a period of five years. It is hardly possible that so little extra fuel would be used in Cuban factories if the cane ground actually carried so small a percentage of fibre. It will presently be shown that by using an accurate method of calculation the Cuban average for 1928-29 would be 12·46 per cent. instead of the 10·56 per cent. fibre as reported.

Until recently the Cristalina variety has made up more than 90 per cent. of the cane ground in Cuba, and now that new varieties are beginning to reduce this preponderance of the old standby it is opportune to examine our methods of fibre calculation.

It is well known that some varieties of cane have a much higher fibre content than others and only accurate methods will give results that may be used in comparing individual varieties with each other and with figures obtained in other countries.

In Cuban factories the fibre per cent. cane is seldom determined by direct analysis, due to difficulties in securing representative samples. The Cuba Sugar Club "Manual of Laboratory Methods" for 1925 gives the following formula on page 8, section 3 : (A) per cent. Fibre in Cane = (per cent. Fibre in Bagasse × Weight of Bagasse/Weight of Cane) 100. The figure per cent. fibre in bagasse is determined indirectly as in Hawaii using the moisture per cent. bagasse and the total soluble solids in bagasse as given by the division of the polarization of the bagasse by the purity of the residual juice as follows :

$$(B)\ \text{Per cent. Fibre in Bagasse} = 100 - \text{Moisture \% Bagasse}\left(\frac{\text{Pol. Bagasse}}{\text{Purity Res.J.}} \times 100\right)$$

$$= 100 - (\text{Moisture per cent. Bagasse plus soluble solids in Bagasse}).$$

The data used in this formula for per cent. fibre in bagasse are directly determined in the laboratory and should be reliable if proper care is used in sampling and in the preservation of the samples of bagasse and residual juice.

The other part of formula "A," the weight of bagasse, is not directly determined, as up to the present time there are no bagasse scales in use in Cuba. Some partial weighing of bagasse has been done over short periods of time by Mr. FERNANDO GUERRERO and his assistants, and in nearly every case showed a much higher percentage of bagasse on cane than resulted from the routine calculations. It is also reported from Louisiana that when the bagasse was shipped to the fibre board factories the weight was appreciably more than given by calculation. It is to be hoped that reliable bagasse scales may soon be installed in some of the Cuban factories.

The method used for determining weight of bagasse is given on page 18, section 4, of the Manual and is as follows :—

Weight of Bagasse = weight of cane + weight of saturation water —
(C) weight of mixed juice.

This is a standard formula and is used in Hawaii. The weight of cane and juice is usually directly determined in Cuba on beam scales, and in some cases the weight of saturation water is also thus determined. However, the reports to the Cuba Sugar Club indicate that in the great majority of mills, this saturation water weight is calculated. It has also been stated that some mills have abandoned weighing of the saturation water, since better efficiency figures could be obtained by using the method of calculation as given in the Cuba Sugar Club Manual. An examination of the results obtained by the use of this method shows that erroneous figures are produced as follows :—

	Item	Error
1.	Fibre per cent. cane	too low
2.	Bagasse per cent. cane	too low
3.	Sucrose per cent. cane	too low
4.	Saturation per cent. cane	too low
5.	Extraction, sucrose per cent. sucrose in cane	too high
6.	Recovery, sucrose in sugar per cent. sucrose in cane.	too high
7.	All ratios based on the above figures IN ERROR.	

This is a formidable list of important data that may appear inaccurately on our reports if the saturation water[1] is not weighed. It will be noted that the two efficiency figures, items 5 and 6, turn out too high when the weight of saturation water is calculated, and this may account for the persistence of this inaccurate method. The fibre per cent. cane, as indicated in the comparison with average figures from Java and Hawaii, turns out too low; in fact, a fibre per cent. cane higher than 12 per cent. has been regarded with doubt in Cuba. Attention is called to this "high fibre" fallacy, by Mr. E. M. COPP, of Porto Rico, in an article entitled "Bagasse and Maceration per cent. Cane" which appeared in *Facts about Sugar*, dated April 7th, 1928.

The method for calculating saturation water per cent. cane is given on page 32, section 2, and also on page 18 of section 4 in the Cuba Sugar Club Manual, as follows :—

$$(D)\quad \frac{100 \times \text{dilution water (arrobas)}}{\text{NORMAL JUICE EXTRACTION}} = \text{Saturation water (arrobas)}$$

This is equivalent to

$$\frac{100 \times \text{dilution per cent. cane}}{\text{NORMAL JUICE EXTRACTION}} = \text{Saturation water per cent. Cane.}$$

The assumption in this expression seems to be that the water sprayed on the bagasse blanket should be extracted in the same proportion as the normal juice. It is readily seen, however, that the conditions under which these two liquids are extracted are quite different, since more than 60 per cent. of the

[1] See Special Note at the end of this paper.

normal juice has been extracted from the cane bagasse before the saturation water reaches the bagasse blanket. In a 6-mill tandem the normal juice is being extracted during the passage through all six mills, whereas as a rule the first two of these mills would have no effect whatsoever on the removal of saturation water from the bagasse blanket.

Mr. F. C. PRAY informs the writer that he began using this formula "D" about 1912 at Central Trinidad. On page 177 of the April, 1915, issue of the *International Sugar Journal*, Mr. LEÓN PELLET, in his article "The Rational Imbibition of Bagasse in the Cane Sugar Factory," gives a formula somewhat similar to the above expression "D." However he seems to confuse imbibition with dilution per cent. cane, since he determines the "imbibition" by multiplying the Dilution per cent. Normal Juice by the Normal Juice Extraction. This operation gives, of course, the dilution per cent. cane just as the multiplication of the dilution per cent. dilute or mixed juice by the dilute extraction will produce the dilution per cent. cane. It is quite possible that the formula "D" has been derived through a confusion of the terms Saturation and Dilution per cent. Normal Juice. The latter figure is always easily determined from the Brixes of the mixed and normal juices and was used years ago, before the advent of water scales as a guide for judging the amount of saturation water being used ; however, it represents only that part of the added water which mixes with the juice and does not include the remaining portion of the saturation water which is carried away with the bagasse. The word *saturation* is used in Cuba (as defined by Mr. NOEL DEERR, on page 310 of the June, 1909, issue of the *International Sugar Journal*) "as meaning any process in which water is added to megass (or bagasse) in order to increase the extraction." At the present time "maceration" seems to be used for this operation in Hawaii and Porto Rico, while in Java the term "imbibition" is used.

As proof that the terms Saturation per cent. Cane and Dilution per cent. Normal Juice have become confused as to meaning in Cuba, the following formula is copied from page 14, section 4, of the Manual :—

$$(E)\ \frac{100 \text{ Dilution per cent. Cane}}{\text{Normal Juice Extraction}} = \text{Dilution per cent. Normal Juice.}$$

It is apparent that the two formulas "D" and "E" are ambiguous and lead to the conclusion that Saturation per cent. Cane is equal to Dilution per cent. Normal Juice. Formula "D" is, of course, wrong and should be eliminated.

A controversy was raging in the pages of the *International Sugar Journal* during the year 1909 on this same subject. The cause of the discussion at that time was a Bulletin No. 22 of the Hawaiian Sugar Planters' Association, based on work by Mr. NOEL DEERR, showing that under conditions of complete admixture the Saturation Water added per cent. Cane, is always higher than the Dilution per cent. Normal Juice. On page 11 of the January 1909 issue of the Journal, Mr. F. NORTH COOMBES of Mauritius maintained that the Saturation Water added per cent. Cane could never be higher than the Dilution per cent. Normal Juice, his opinion being founded on simple and not compound saturation. On page 193 of the April number of the same Journal, M. HENRI PELLET stated that the dilution per cent. normal juice was always higher than the saturation per cent. cane. I believe that practical experience during the past twenty years has shown that Mr. NOEL DEERR was right and that our present day compound saturation approximates closely to the conditions of his complete admixture statement.

Some of the data adduced by Mr. DEERR to explain his contention, appearing in January, 1909, referred to above, are as follows :—

Saturation per cent. Cane	20·00	Dilution per cent. Normal Juice	15·75
Dilution per cent. Cane	13·06	Dilution per cent. Cane	13·06
Bagasse Dil. per cent. Cane ..	6·94	Difference	2·69

It will be noticed that the difference between the figure for Saturation per cent. Cane and that for Dilution per cent. Cane is 6·94, and I have called this *Bagasse Dilution per cent. Cane*, since this is the portion of the saturation water that remains in the bagasse. The difference between the Dilution per cent. Normal Juice and the Dilution per cent. Cane is only 2·69, which corresponds to the difference between the so-called Saturation per cent. Cane (actually Dilution per cent. Normal Juice) and the Dilution per cent. Cane of 3·58 for 94 Cuban factories during the 1929 crop. Mr. E. M. COPP, in the article referred to above, stated that he found this Bagasse Dilution per cent. Cane to be 7·05 in averaging up the results from some 40 Hawaiian mills with those from other factories issuing reliable report data.

It is interesting to note the close range of this Bagasse Dilution per cent. Cane figure in the very complete Summaries of Factory Reports issued each year by the Planters' control laboratories in Java and Hawaii. Comparative Statements of Final Crop Data are worth a great deal in compiling important average control figures, and it is hoped that the scope of the Cuba Sugar Club's Crop Final Summaries will be enlarged to include all the data reported by each factory. The following figures have been taken from the Java and Hawaii Annual Reports, and the data for Cuban factories has been taken from the Comparative Statements of the Cuba Sugar Club, added up and averaged.

	CUBA.			HAWAII.			JAVA.		
Year	Sat. per cent. Cane	Dil. per cent. Cane	Dif.	Sat. per cent. Cane	Dil. per cent. Cane	Dif.	Sat. per cent. Cane.	Dil. per cent. Cane.	Dif.
1924	—	—	—	34·90	27·70	7·20	16·80	9·90	6·90
1925	15·27	12·21	3·06	32·63	26·55	7·08	17·70	10·68	7·02
1926	15·67	12·57	3·10	33·61	26·68	6·93	17·30	10·40	6·90
1927	14·53	11·49	3·04	32·53	25·66	6·87	17·50	10·50	7·00
1928	16·55	13·08	3·47	32·16	25·35	6·81	17·65	10·62	7·03
1929	17·55	13·97	3·58	—	—	—	—	—	—
5-year avg.	15·91	12·66	3·25	33·37	26·39	6·98	17·39	10·42	6·97

The figure that I have taken the liberty to call Bagasse Dilution per cent. Cane averages very close to 7 for the 5-year period in both Java and Hawaii, and only about half this number for Cuba. The figures are as follows :—

Period	Country	Bagasse Dilution per cent. Cane
Five year Average	Hawaii	6·98
,, ,, ,, ...	Java ...	6·97
,, ,, ,, ...	Cuba	3·25

These averages (Java and Hawaii) agree closely to the figure 6·94 found from the work of Mr. NOEL DEERR mentioned above as having been debated during the year 1909. If we are twenty years behind in our methods it is about time to make a change and get in step.

It will be noticed that the amount of saturation (33·37) used in Hawaii is nearly double that in Java (17·39), yet the portion going away with the bagasse is nearly the same for the two 5-year periods. This seems to corroborate the statement made by Mr. E. M. COPP, that the amount of saturation water absorbed by the bagasse is nearly constant at all dilutions or saturations.

This is probably a logical conclusion providing there is no great variation in the fibre content of the cane. It is possible that cane fibre has a specific absorption rate for saturation water and it may be that some research has been done or could be done on this point. The average five-year figure for Cuba as shown in the above table, 3·25, is less than half that found for Java and Hawaii, and is of course not really comparable, since it is the difference between the Dilution per cent. Cane and the Dilution per cent. Normal Juice, while the figures 6·97 and 6·98 are the differences between the Dilution per cent Cane and the Saturation per cent. Cane. The real Saturation per cent. Cane for Cuba over this period is probably closer to 19·66, obtained by adding 7 to 12·66, than it is to 15·91. This places the amount of saturation used in Cuba in between those of Java and Hawaii, and the figure for Bagasse Dilution per cent. Cane should fall very close to 7. It is now time for us to discontinue calling the Dilution per cent. Normal Juice the Saturation per cent. Cane, and give the latter term its real value and significance.

This can only be done accurately by weighing the saturation water or calculating its weight from measurement and temperature data. If a practical bagasse scale is developed this could also be used and allow an accurate determination of the saturation water weight from the following formula :—

(*F*) Bagasse weight = weight of cane + weight of saturation water — weight of dilute or mixed juice.

When any three of these weights are known, the fourth can be correctly determined, so that either a water or bagasse scale may be installed to provide the third item since the cane and juice are weighed now in nearly every factory. All factories having means to obtain three of these weights directly should use the excellent method developed by Mr. E. E. DOMINGUEZ and published on page 298 of the Proceedings of the Cuban Technologists' Society for 1927. This method eliminates all factors and provides for a direct determination of the Normal Juice Brix by simple arithmetical means based on the above three weights and the regular laboratory data. An example of a partial daily report calculation using this exact method will be given later so that it may be compared with the system herein suggested for use in factories where only the weights of cane and mixed juice are known.

Since it will probably continue to be impossible for many factories to determine more than two of the weights required for formula "F," another method will now be proposed which will give results corresponding to formula "F," providing that the Normal Juice Brix is correctly determined. For this purpose the expression "F" will be re-arranged as follows :—

(*G*) Saturation water weight = weight of Bagasse + weight of Dilute Juice — weight of Cane.

Percentages may be substituted and we have :—

(*GG*) Saturation per cent. Cane = Bagasse per cent. Cane + Dilute Extraction per cent. Cane — 100.

The Bagasse per cent. Cane must now be determined and a formula is given in the article referred to previously by Mr. E. M. COPP, as follows :—

(*H*) Bagasse per cent. Cane =

$$\frac{100 + \text{Dil. per cent. Cane} - \text{Dilute Ext. per cent. Cane}}{\dfrac{\text{Fibre p.c. Bagasse}}{100} + \dfrac{100 - \text{Fibre p.c. Bagasse} - \text{moisture p.c. Bagasse}}{\text{Normal Juice Brix}}}$$

This may be re-written to read as follows :—

(*HH*) Bagasse per cent. Cane =

$$\frac{100 - \text{Normal Extraction per cent. Cane}}{\dfrac{\text{Fibre per cent. Bagasse}}{100} + \dfrac{\text{Brix Bagasse}}{\text{Brix Normal Juice}}}$$

The Brix of the Bagasse is of course the total soluble solids and is obtained by dividing the bagasse polarization by the residual juice purity ; this with the other components is determined in the daily routine analysis. The correct determination of the Normal Juice Brix is of great importance in the results secured by this formula, as the following example will show. The 1929 Final Data, as shown on the Cuba Sugar Club Comparative Statement, have been added up and averaged with these average crop figures resulting :

Normal Extraction 80·57 ; Normal Juice Brix 19·25

Fibre per cent. Bagasse 45·90 ; Bagasse Solids 4·77.

Substituting these figures in the formula " HH " we obtain

$$\text{Bagasse per cent. Cane} = \frac{100 - 80{\cdot}57}{\dfrac{45{\cdot}90}{100} + \dfrac{4{\cdot}77}{19{\cdot}25}} = \frac{19{\cdot}43}{0{\cdot}7068} = 27{\cdot}49.$$

The average dilute extraction per cent. Cane was 94·54 ; this would then give according to formula " GG " Saturation per cent. Cane = 27·49 + 94·54 — 100 = 22·03, as compared with a reported 17·55 per cent. Saturation per cent. Cane (actually the Dilution per cent. Normal Juice). From these figures the Bagasse Dilution per cent. Cane is 22·03 — 13·97 or 8·06, rather higher than the number 7 which has been shown to be a practical average figure.

The influence of the Normal Juice Brix will now be shown by assuming the average to be 18·75 instead of 19·25 as reported. The Dilution per cent. Cane would then be 94·54 — 82·69 or 11·85 in this case, the Normal Extraction being 82·69 and the other figures remaining the same.

$$\text{Bagasse per cent. Cane} = \frac{100 - 82{\cdot}69}{\dfrac{45{\cdot}90}{100} + \dfrac{4{\cdot}77}{18{\cdot}75}} = \frac{17{\cdot}31}{0{\cdot}7134} = 24{\cdot}26.$$

And Saturation per cent. Cane = 24·26 + 94·54 — 100 = 18·80. Then the Bagasse Dilution per cent. Cane figure would be 18·80 — 11·85 or 6·95, somewhat closer to the number 7 mentioned. It may be found advisable to vary the Normal Juice Factor so that a close approximation to this number will be obtained.

By applying the formula " HH " to the average figures reported for 94 factories during 1929 to the Cuba Sugar Club the accompanying comparative statement of reported and calculated data has been prepared.

The 94 mills have been separated into four divisions according to the reported fibre per cent. cane. There were 19 with fibre less than 10, 55 reported fibre between 10 and 11, 15 between 11 and 12, and only five reported fibre over 12 per cent. on cane.

The Bagasse Dilution per cent. Cane as re-calculated is 8·06, a unit higher than the figure 7 which may be regarded as normal. This discrepancy is probably due to inaccuracy in determining the Normal Juice Brix as previously mentioned. The re-calculation merely indicates the difference to be expected from the use of a more accurate method of saturation water determination. The mill efficiency, as indicated by the sucrose extraction of 93·91, as reported

COMPARISON OF REPORTED AND RECALCULATED FIGURES.

No. of Mills	Fibre per cent. Cane Rep.	Fibre per cent. Cane Calc.	Bagasse per cent. Cane Rep.	Bagasse per cent. Cane Calc.	Saturation per cent. Cane Rep.	Saturation per cent. Cane Calc.	Dilution per cent. Cane Rep.	Bagasse Dilution per cent. Cane Rep.	Bagasse Dilution per cent. Cane Calc.	Sucrose Extraction per cent. Cane Rep.	Sucrose Extraction per cent. Cane Calc.	Sucrose Recovery Rep.	Sucrose Recovery Calc.
19	9·57	11·88	21·15	26·23	15·38	20·54	12·66	2·72	7·88	94·45	93·28	86·40	85·34
55	10·51	12·46	22·95	27·82	16·89	21·76	13·65	3·25	8·12	93·84	92·69	86·00	84·95
15	11·46	13·14	24·50	28·07	19·24	22·81	14·74	4·50	8·07	93·49	92·64	85·16	84·41
5	12·27	12·64	26·32	27·11	27·71	28·50	20·25	7·46	8·25	93·86	93·73	85·56	85·44
94	10·56	12·46	23·01	27·49	17·55	22·03	13·97	3·58	8·06	93·91	92·90	85·92	85·00

COMPARISON OF REPORTED AND RECALCULATED FIGURES.

No. of Mills	N. J. Brix Reported	N. J. Ext. Reported	D. J. Ext. Reported	Sucrose per cent. Cane: Extracted Rep.	Sucrose per cent. Cane: Bagasse Rep.	Sucrose per cent. Cane: Bagasse Calc.	Sucrose per cent. Cane: Total in Cane Rep.	Sucrose per cent. Cane: Total in Cane Calc.	Sucrose per cent. Cane: Total in S. Rep.	Bagasse Analysis: Brix	Bagasse Analysis: Pol.	Bagasse Analysis: Moisture	Bagasse Analysis: Fibre.
19	19·00	81·65	94·31	12·91	0·76	0·93	13·67	13·84	11·81	4·68	3·55	50·00	45·32
55	19·35	80·30	93·94	12·93	0·85	1·02	13·78	13·95	11·85	4·84	3·67	49·36	45·80
15	19·05	80·00	94·74	12·83	0·89	1·02	13·72	13·85	11·69	4·66	3·63	48·54	46·80
5	19·82	81·14	101·39	13·45	0·89	0·91	14·33	14·45	12·26	4·55	3·37	48·83	46·62
94	19·25	80·57	94·54	12·94	0·84	0·99	13·78	13·93	11·84	4·77	3·62	49·33	45·90

has fallen a point to 92·90 in the re-calculation. Few sugar men would want to continue fooling themselves with the higher extraction based on incorrect methods. The sucrose extraction is not now regarded as the best figure for comparison of mill work, since one of the variables that affect it is not considered in the extraction figure. The fibre in the cane is the chief influence on extraction of juice and sucrose from cane, and should be taken into consideration.

In the 1928 "Reference Book of the Sugar Industry," (page 42), Dr. PH. VAN HAAREVELD states : "The best basis for comparisons (of mill work) proved to be the undiluted (Normal) juice which remains in the bagasse, calculated per 100 fibre in bagasse and cane. Fibre determines chiefly the work of a mill tandem. The extraction of juice from fibre is the real purpose of mill work." He also says that this basis has been used in Java since 1922. We may consider the cane to consist of juice and fibre, and the total normal juice in the cane is 100—fibre. The Normal juice extraction indicates the portion extracted and therefore the part left in the bagasse will be given by the expression : 100 — fibre per cent. Cane — Normal Juice Extraction per cent. Cane. Using this method of comparing mill work, we may derive the following data :—

	Cuba 1929 Figures Reported		Recalculated
Sucrose Extraction	93·91	..	92·90
Fibre per cent. Cane	10·56	..	12·46
Total Normal Juice in Cane	89·44	..	87·54
Normal Juice Extraction per cent. Cane	80·57	..	80·57
Normal Juice lost in Bagasse	8·87	..	6·97
Parts Normal Juice lost per 100 Fibre	84·00	..	56·00

This shows that the normal juice lost per 100 fibre was 50 per cent. greater according to the reported figures than that indicated by the re-calculated figures. The term "milling loss" is used in the Hawaiian Islands to indicate the part of normal juice lost in the bagasse which was 8·87 for the reported high extraction data and 6·97 for the re-calculated figures, i.e., the milling loss is greater with the apparent higher sucrose extraction.

This is a contradiction in itself and demonstrates the misleading conclusions that follow the use of the Formula "D." The following figures will show how our reported and recalculated figures compare with those from Java and Hawaii.

COMPARISON OF MILLING RESULTS.

Country	Sucrose Extraction	Fibre per cent. Cane	Normal Juice In Cane	Normal Juice Extracted	Milling Loss	Normal Juice Lost per 100 Fibre
Cuba (1929) Rep.	93·91	10·56	89·44	80·57	8·87	84
Cuba (1929) Re-calc	92·90	12·46	87·54	80·57	6·97	56
Java (5-year ave.)	93·79	12·78	87·22	81·48	5·74	45
Hawaii (5 year ave.)	97·27	12·62	87·38	84·51	2·87	23

After a glance through these data there should remain little doubt that change is necessary in Cuban methods of calculation.

It is now suggested that all Cuban mills try out the methods outlined in this paper, and for their guidance an example of partial daily report calculation will now be given. The first method is for mills which have the weights of cane, mixed juice and saturation water and is based on the work of Mr. E. E. DOMINGUEZ referred to before. The second method is for mills weighing only mixed juice and cane and is based on the formula "HH" derived from that of Mr. E. M. COPP also mentioned above.

Method No. 1.

Data known.—

Weight of cane 200,000
Weight of mixed juice 198,000
Weight of saturation W. 47,480

Mixed Juice, Brix 15·80, Suc. 13·27, Pur. 84·00.
Residual Juice Purity, 73·00.
Bagasse Pol. 3·5, Moisture 49·00.

Dil. Ext. is :

$$\frac{198,000}{200,000} \times 100 \text{ or } 99 \text{ per cent Cane}$$

Sat. per cent. Cane is :

$$\frac{47,480}{200,000} \times 100 \text{ or } 23{\cdot}74$$

Weight of Bagasse is :—

	47,480	(Wt. Sat. Water)
	200,000	(Wt. Cane)
	247,480	(addition)
	198,000	(Wt. Mixed Juice)
Wt. of Bag.	49,480	

Bagasse per cent. Cane is :

$$\frac{49,480}{200,000} \times 100 \text{ or } 24{\cdot}74$$

Brix Bagasse is $\frac{3{\cdot}50}{73{\cdot}00} \times 100$ or 4·80

Fibre in Bagasse is

49·00	(Moisture)
4·80	(Brix Bagasse)
53·80	(addition)
46·20	(100—53·80)
100·00	

Fibre per cent. Bagasse is 46·20.

Fibre per cent. Cane is :
46·20 × 0·2474 or 11·43.

Total Normal Juice in Cane is :
100 — 11·43 or 88·57.

Brix Bagasse per cent. Cane is :
4·80 × 0·2474 or 1·19

Brix Juice per cent. Cane is :
15·80 × 0·99 or 15·64

Brix of Cane is 1·19 + 15·64 or 16·83

Then Normal Juice Brix is :

$$\frac{16{\cdot}83}{88{\cdot}57} \times 100 \text{ or } 19{\cdot}00$$

Normal Extraction per cent. Cane is :

$$\frac{15{\cdot}80}{19{\cdot}00} \times 99{\cdot}00 \text{ or } 82{\cdot}32$$

Dil. per cent. Cane is :
99·00 — 82·32 or 16·68

Method No. 2.

Data known.—

Weight of Cane 200,000
Weight of mixed juice 198,000
Mixed Juice, Brix. 15·80, Suc. 13·27, Purity 84

Normal Juice, Brix. 19·00, Suc. 15·81, Purity 83·22.
Residual Juice Purity 73·00
Bagasse Pol. 3·5, Moisture 49·00

Dil. Ext. is $\frac{198,000}{200,000} \times 100$ or 99·00 per cent. Cane.

Normal Ext. is $\frac{15{\cdot}80}{19{\cdot}00} \times 99{\cdot}00$ or 82·32

Dil. per cent. Cane is 99·00 — 82·32 or 16·68.

Brix Bagasse is $\frac{3{\cdot}50}{73{\cdot}00} \times 100$ or 4·80

Fibre per cent. Bagasse is :
100 — (49·00 + 4·80) or 46·20

Formula "HH"

Bagasse per cent. Cane is :

$$\frac{100 - 82{\cdot}32}{\dfrac{46{\cdot}20}{100} + \dfrac{4{\cdot}80}{19{\cdot}00}}$$

or 24·74 (Bagasse per cent. Cane)

Weight Bagasse is :
200,000 × 0·2474 or 49,480

Fibre per cent. Cane is :
0·2474 × 46·20 or 11·43.

Total Normal Juice in Cane is :
100 — 11·43 or 88·57.

Saturation Weight and per cent. Cane is found as follows :

	Weight.	Per cent. Cane.
Bagasse	49,480..	24·74
Mixed Juice	198,000..	99·00
	247,480..	123·74
Cane	200,000..	100·00
Saturation W.	47,480..	23·74

CHECK.

Bagasse Dil. per cent. Cane is :

23·74 — 16·68 or	7·06
Milling loss is 88·57 — 82·32 or	6·25
Fibre per cent. Cane	11·43
Bagasse per cent. Cane	24·74

SUCROSE ACCOUNT.

Weight.			Per cent. Cane.
26,274	..	In Juice ..	13·13
1,732	..	In Bagasse ..	0·87
28,006	..	Total in Cane ..	14·00

Normal Juice Sucrose is :

$$\frac{14{\cdot}00}{88{\cdot}57} \times 100 \text{ or } 15{\cdot}81$$

Normal Juice Purity is :

$$\frac{15{\cdot}81}{19{\cdot}00} \times 100 \text{ or } 83{\cdot}22$$

Sucrose Extraction is :

$$\frac{26{\cdot}274}{28{\cdot}006} \times 100 \text{ or } 93{\cdot}82$$

Normal Juice lost per 100 fibre is :

$$100 \times \frac{88{\cdot}57 - 82{\cdot}32}{11{\cdot}43} \text{ or } 55$$

CHECK.

Bagasse Dil. per cent. Cane is :

23·74 — 16·68 =	7·06
Milling Loss is 88·57 — 82·32 or	6·25
Fibre per cent. Cane is	11·43
Total gives the Bagasse per cent. Cane	24·74

SUCROSE ACCOUNT.

Weight.			Per cent. Cane.
26,274	..	In Juice ..	13·13
1,732	..	In Bagasse ..	0·87
28,006	..	In Cane ..	14·00

Sucrose Extraction is :

$$\frac{26{\cdot}274}{28{\cdot}006} \times 100 \text{ or } 93{\cdot}82$$

Normal Juice lost per 100 Fibre is :

$$100 \times \frac{88{\cdot}57 - 82{\cdot}32}{11{\cdot}43} \text{ or } 55$$

SPECIAL NOTE.—This paper was prepared before the publication, in the September 1929 issue of the *International Sugar Journal*, of the Fourth Communication from the Special Committee of the International Society of Sugar Cane Technologists on "Uniformity in Reporting Factory Data." The following terms used in this paper may be interpreted thus :

Normal Juice	to be superseded by	Absolute Juice.
Dilute Juice	,, ,, ,,	Mixed Juice.
Saturation	,, ,, ,,	Imbibition.
Bagasse Dilution	,, ,, ,,	Imbibition Water in Bagasse.
Sucrose (direct)	,, ,, ,,	Pol.

The ideas and formulas in the subject matter above seem to coincide with those recommended by the Special Committee.

CUBA CANE SUGAR CORPORATION.—The Cuba Cane Sugar Corporation, the huge Hayden-Rionda concern in Cuba, has had to file a petition in bankruptcy in the New York law-courts, and latest advices are that the receivership has been made absolute against them, though a re-organization plan was submitted for the approval of the court. This failure is a natural outcome of the difficulties encountered in Cuba under existing low prices.

CHEMICAL CONTROL.—As showing the accuracy of modern control methods properly conducted, J. Zameron, the well-known French chemist,[1] gives the following example : analysis of the roots entering into process, 10,824,868 kg. ; and sugar in the diffusion juice, 10,824,532 kg., a difference of only 336 kg., which expressed as a percentage is in the third place of decimals. He used the hot digestion method with defecation by basic lead acetate for determining the sugar in the roots.

[1] *Bull. Assoc. Chim. Sucr. France*, 1929, **46**, 257-264.

Some Thoughts on the Milling of POJ Canes.

By ARTHUR H. ROSENFELD,
Consulting Technologist of the American Sugar Cane League.

The Fibre Content of the POJ Canes and its Significance.

A frequent objection made to the POJ canes is the difficulty of milling them, on account of the higher fibre content as compared with the Striped, Purple or D 74 type of cane. On the other hand, many persons of experience consider that the higher fibre content of these canes, instead of being a disadvantage, is a very decided point in their favour, taking into consideration the increased resistance of the higher fibre-content canes against the attacks of the common moth borer, *Diatraea saccharalis*, and the additional amount of bagasse supplied by these canes for the furnace—or, in Louisiana, for sale for the manufacture of " Celotex " board.

The following table gives the fibre contents of the three POJ canes discussed here, in comparison with the La. Purple and Striped, representing the averages of a number of fibre determinations made at the Tucuman Sugar Experiment Station, Argentina.

Fibre Contents.

Variety.	Per cent. fibre in canes.
POJ 36	12·80
POJ 213	13·00
POJ 234	12·20
Louisiana Purple and Striped	10·60
Average POJ	12·66

It will be observed that all of the Java varieties run very considerably higher in fibre than the La. Purple and Striped, averaging a 20 per cent. increase.

Effect on Milling Results.

Despite the many opinions to the contrary which one frequently hears expressed, there is no doubt that, with proper adjustment of the crusher rolls and the necessary changes in the feed to meet the conditions of a thinner cane with decidedly higher fibre content (which means, of course, that a layer of the POJ cane of the usual depth on the conductor will contain more fibre and hence offer more resistance to the mills than is indicated by the comparison of the fibre contents of the POJ canes and the La. Purple or D 74, since the thinner canes fit more closely together and a considerably greater weight of cane will pass over the conductor than with the same thickness of layer of the thicker canes), very good milling results can be obtained from these canes, although their higher fibre content does undoubtedly signify a certain percentage reduction in the grinding capacity per hour of any properly adjusted milling plant and a probable small decrease in extraction under normal conditions.[1]

In studying this question the writer a number of years ago, making use of the very complete Mutual Control Reports from Java, compiled the comparative manufacturing figures for two sets of sugar mills in that progressive island—one lot representing the twenty-three plants which for an entire crop ground cane with an average fibre content of above 13 per cent., higher than the average content of the POJ seedlings we have been discussing, and the other representing the 17 factories which that year ground cane averaging less than 11 per cent. fibre, which compares quite well with our La. Striped and Purple and D 74. The results found in the Table below are extremely interesting.

---

1 Rosenfeld, Arthur H. Las Caños de Java en la Estacion Experimental Agricola La Gaseta de Tucuman, Argentina; May 1914.

TABLE I.—Results obtained in Java from Factories grinding Cane of High and Low Fibre Content.

Fibre in Cane.	No. Factories.	Per cent. Sucrose in Cane.	Per cent. Sucrose extracted on 100 per cent. Cane.	Per cent. Juice, extracted on 100 parts Juice.	Fibre in Cane.	Bagasse data per cent. Sucrose	Moisture	Sucr. lost
Below 11	17	12·50	11·49	91·3	10·58	4·72	48·45	1·1
Above 13	23	12·25	11·06	90·3	13·61	4·29	44·99	1·1

There was little difference, then, between the results obtained by the two groups, the most important one from the calorific standpoint being that the bagasse from the high-fibred cane had 3½ points less humidity than that from the mills grinding canes of low fibre content. The average per cent. sucrose in cane was slightly better in the group of centrals grinding low-fibre cane and they obtained one point better extraction than the mills grinding cane of higher-fibre content, losing, also, slightly less sucrose in the *bagasse*. Mechanical practices, unlike agricultural ones, can be pretty well applied in any country and there is no satisfactory reason why milling results achieved with these canes in Java and Argentina should not be duplicated in the average Louisiana or Hawaiian factory having equivalent machinery. POJ 36 is rapidly gaining favour in Hawaii on those areas not well suited to H 109.

EXPERIMENTS IN LOUISIANA IN 1926.

Even after it was recognized half way through the growing season of 1926 that the POJ canes had proved their ability to give far superior yields in the field to those of the old canes, considerable scepticism was expressed as to the possibility of properly milling these canes without an enormous drop in capacity and increased risk of breakage and, therefore, of hold-ups during crop. After our experience in the Argentine, where the new canes had been handled with no particular difficulty in mills, which on the average were far inferior to the mills grinding in Louisiana in recent years, the writer felt confident that history was again repeating itself and that just as in Tucuman the Java canes had replaced the native canes despite the conviction of a number of planters there that it could not be done, and later these canes had been handled in the mills without any particular changes except measures to increase capacity due to the larger amount of cane available for all factories,—so in Louisiana the sequence of events was bound to result substantially the same.

Probably the first official Louisiana mill test of the POJ 234 was arranged on December 4th, 1926, when some 40 tons of cane of this variety from Southdown Plantation were ground at Ardoyne factory, the demonstration being conducted co-operatively by the American Sugar Cane League, the Office of Sugar Plants of the U.S. Department of Agriculture and the State Experiment Station. Ardoyne had a milling plant consisting only of a crusher and six rolls and would certainly be below the average as to strength of mills of the factories grinding in 1926. No changes were made in the setting of the mills when the test of the POJ 234 was made. The factory had been grinding D 74 and a space was simply left on the conductor and the POJ 234 sent through loaded on the conductor more or less as the D 74 had been.

During the grinding of this cane, the test of which was attended by quite a large number of representative planters from all over the State, no particular difficulty was observed in the taking of the cane by the crusher or mills.

Considering the equipment, the cane was well handled, and the following figures will show the comparative analyses of the mixed juice of the two types of cane. The per cent. of fibre shown in POJ 234 was 13·93, that of the D 74, while not determined at that particular time, running around 11 per cent. during that grinding. The bagasse was taken to Baton Rouge for analysis and, therefore, lost some moisture before being analysed.

TABLE II.—Test on POJ 234, Ardoyne Factory—1926.

Mixed Juice.

	Juice Analysis.				Bagasse Analysis.		
Variety	Brix.	Sucrose.	Purity.	Acidity.	Moisture.	Fibre.	Sucrose
D 74	13·1	10·20	71·0	3·50	—	—	—
POJ 234	14·8	11·16	75·4	2·85	49·5	43·28	5·06

Variety.	Extraction.	Available Sucrose per Ton of Cane. Pounds.
D 74	70·0	122·0
POJ 234	67·8	141·6

The above test, while a fairly small one due to the scarcity and high price of seed and the reluctance on every one's part to sacrifice sufficient of this valuable seed to permit of a real run being made with the POJ 234 cane, did serve to inspire considerable confidence in a number of the mill men present. Meanwhile, Southdown handled a large amount of Cayana cane at their factory without anything abnormal occurring and at Augusta Plantation, near Opelousas, 10 tons of POJ 234 had been run through the mill on the 26th of November, the mill again taking this cane without any difficulty, and the following comparative mixed juice analyses were obtained :—

TABLE III.—Augusta Mill Test, 1926.

Variety.	Brix.	Sucrose.	Purity.
Native	14·0	10·00	71·4
POJ 234	16·0	11·64	77·6

Also, on the 18th of November, Mr. P. G. SONGY had conducted a public demonstration of the grinding of Cayana cane on the six-roll mill and crusher equipment at Evergreen Factory, Wallace, Louisiana. Mr. SONGY kindly furnished the figures contained in Table IV, showing some comparative figures for the Purple cane which he was grinding just previously to starting the Cayana through the mill. These results speak for themselves and again it may be said that no particular difficulty was encountered in the handling of this high-fibred cane by a rather low-powered mill.

TABLE IV.—Evergreen Factory, Wallace, La.

The following data were obtained on the Cayana Mill Test conducted at Evergreen Factory on Monday, November 8th, 1926.

	Cayana	Purple
Hours Grinding	5·75	—
Tons Cane Ground	80·50	—
Tons Cane Ground per Hour	14·00	—
Rate Grinding per Day	336·00	—
Per cent. Mill Extraction	70·75	74·00
Per cent. Dilution	—	—
Normal Juice Brix	14·26	13·10
Normal Juice, per cent. Sucrose	9·75	9·50
Normal Juice, per cent. Purity	68·37	72·52
Bagasse, per cent. Moisture	55·40	—
Syrup, Gallons, per Ton	23·19	21·00

One of the most important tests conducted during 1926 was the large mill trial carried out at the Billeaud Factory at Broussard, Louisiana, on Armistice Day, 1926. This is reported on by R. D. RANDS and SIDNEY F. SHERWOOD in U.S. Department Circular 418 under the title, " Yield Tests of Disease-Resistant Sugar Canes in Louisiana," and for details as to type of land, cultivation, etc., readers are referred to this interesting circular. The test was carried out on cane grown on the Plantation of Mr. P. R. LANDRY, near Lafayette. The experimental cane was harvested and weighed November 8th to 10th, which is rather earlier than the average date for grinding plant cane in Louisiana. It is interesting to note in connection with the harvesting that, as regards ease of stripping, Mr. LANDRY ranked the varieties as follows : Louisiana Purple (easiest) followed by POJ 36, 234 and 213. The Billeaud factory has a well equipped grinding plant and the POJ canes were handled by this mill with no unusual difficulty.

The data in Table V are taken from the tables given on page 16 of Circular 418. In the words of Drs. RANDS and SHERWOOD, " The results of the experiment, as a whole, therefore show than even in a locality such as this, where fair yields are still obtained from the old varieties, a considerable increase is promised in the substitution of more vigorous canes."

TABLE V.—Mill Test at Billeaud factory, Lafayette, La., November 11th, 1926. Sugar Cane from test on the P.R. Landry Plantation.*

Variety	Per cent. of juice extraction.	Available 96° sugar† (lbs. per ton of cane) Basis of juice extraction actually obtained.	Tons cane for 1 ton sugar.	Tons cane per acre.	Available 96° sugar† (lbs. per acre) Basis of juice extraction actually obtained.
Louisiana Purple	75·13	172·5	11·2	12·93	2,230
POJ 36	69·06	135·5	13·1	16·54	2,241
POJ 213	68·04	142·7	12·2	16·23	2,316
POJ 234	70·95	176·4	10·3	16·49	2,909

Mixed juice from crusher and all mills.

Variety	Brix (17·5°C.)	Polarization	Purity (apparent)	Per cent. " glucose " (reducing sugar as invert sugar)
Louisiana Purple	15·50	12·30	79·4	1·53
POJ 36	14·95	11·00	73·6	1·86
POJ 213	14·90	11·45	76·8	1·40
POJ 234	16·35	13·20	80·7	1·14

SOME 1927 EXPERIENCES.

In 1927, as is commonly known, almost every operative mill ground some proportion of the POJ 234 cane, and there were probably a quarter of a million tons of this variety milled throughout the State. Due to the fact that practically all of the mills ground a considerable amount of the D 74 and native cane, practically none of the mills' settings were changed to adapt them especially to the grinding of the POJ canes. Unfortunately, too, on account of the necessity of grinding the various classes of cane, the number of controlled runs on POJ cane alone was practically negligible, so that in considering the grinding season as a whole we can draw our conclusions only from the reports of the different mills on the ease or difficulty of handling the new canes in mills set primarily for receiving the old low-fibred canes and on the chemical control data for the different varieties where these were

* No maceration water used. † Winter-Carp (Java) formula and polarization and purity of mixed juice used; on basis of boiling house efficiency of 100 per cent.

kept separate, all of which, it may be said, show a very distinct advantage for the POJ 234 cane over the old varieties in lbs. of sugar produced per ton of cane ground. From data which the writer has been able to obtain he feels that he is making a conservative statement in saying that the POJ 234, even though ground with mill settings not especially arranged for the reception of this cane, yielded at least 20 lbs. of sugar more per ton of cane than the old varieties taken on an average all over the State.

The writer kept very closely in touch with the grinding operations and particularly with any reports of milling difficulties with the new canes. On the whole we would say that mill breakages were rather below the average number during the past season and very few of these can be traced to the milling of the new canes. At Raceland a crown gear on the crusher was broken and this was undoubtedly due to the very high-fibred cane that was being milled at this time, which was reported as POJ 36. Investigation, however, showed that this was a variety which had been labelled POJ 36 at the Experiment Station at Baton Rouge, but was in reality one of the United States seedlings, which, like so many of its sister canes, is extremely high in fibre and ridiculously low in sucrose.[1] The Greenwood factory near Thibodaux, which ground a very large proportion of the new canes, early in the season reported three breakages of mill housings, but investigation by competent engineers showed that this breakage was due to faulty alignment of the crusher, and when this trouble was corrected the factory ground almost exclusively POJ 234 and Cayana canes the rest of the season without any trouble. At Waterford, a crusher housing was broken rather late in the season, but upon examination it was evident by the rusted condition of a large part of the broken surface that this housing had been cracked for a long time. A number of the mills reported irregular feed and popping-off by the hydraulics as a result of this, which trouble, it is likely, could be easily corrected by the use of some levelling device such as rotating knives, either at the foot or at the apex of the conductor—or even at both points. Some of the mills seemed to handle the new canes without any difficulty whatsoever and managed to get a tonnage through their mills very comparable to that handled with the old canes. In fact, in one case—at Raceland—Mr. JULES GODCHAUX stated to the writer that he thought the POJ cane milled better than the old varieties.

The first striking mill test of POJ 234 cane in comparison with the D 74 and Ribbon varieties was made very early in the 1927 season by Mr. P. G. SONGY, Vice-President of Songy Sugars Company, at Evergreen Plantation on October 26th and 27th. The following report by Mr. SONGY is self-explanatory.

TABLE VI.—Results of Grinding at Evergreen Plantation (Property of Songy Sugars Co., Inc). October 26th,—27th, 1927.

Stubble Cane, D 74 and Ribbon Varieties.

Brix.	Sucrose.	Purity.
13·1	10·72	70·9

The factory operated on these canes for 10·77 hours, ground at the rate of 18 tons per hour, or 432 tons per day.

Dilution.	Extraction.
12·3	71·8

[1] ROSENFELD, ARTHUR H. Plantation Trials of Unproven Varieties not advisable. *The Sugar Bulletin*, Vol. VI, 6. December 15th, 1927.

POJ 234 Plant Cane.

The factory ground POJ 234 plant cane for 8·52 hours, at the rate of 18 tons per hour, 432 tons per day.

Brix.		Sucrose.		Purity.
15·6	..	12·27	..	78·6
Dilution				Extraction.
11·9		..		68·6

This factory is rated at about 500 tons per day, but very seldom has ground that much cane, so the rate per day is satisfactory.

A splendid comparison of the new and old canes is obtained from figures kindly furnished by Mr. JULES GODCHAUX, of Godchaux Sugars, Inc. regarding comparative results from the new types of cane and the old in a factory the chemical control of which has probably no superior in the State and, furthermore, in a large capacity factory having very high class equipment. Analyses were made throughout the season of the juices of the different varieties of cane from the different localities as they were run through the mill and averages made up for the season of these different analyses. During this crop, in which Raceland handled over 50,000 tons of cane, 42·7 per cent. was of the POJ and Cayana varieties and 57·3 per cent. of the D 74 and Native varieties, a good proportion of the latter coming from the high-sucrose western section where mosaic disease had not yet attained the maximum virulence and where the sucrose content is far superior to that of the same varieties in the eastern section. The average sucrose content of the normal juice of the Native and D 74 canes during the season was 11·32 per cent. and that of the POJ and Cayana (and it must be admitted that the Cayana very naturally reduced the average for the POJ) was 13·43 per cent. Extraction for the season averaged over 78 per cent. and over 176 lbs. of 96° sugars were made per ton of cane ground.

At Southdown on November 30th, Mr. D. W. PIPES gave the writer the following figures on recoveries from a controlled run of 11,797½ tons of cane consisting of 40 per cent. POJ 234 ; 30 per cent. Cayana ; and 30 per cent. of old cane. His figures of recoveries of sugar per ton for this run are as follows :—

	Lbs.
In Bag 96°	135·00
In Process 96°	16·57
In Syrup	34·91
Total	186·48

Mr. PIPES further stated that for the POJ 234 alone the recovery was over 200 lbs. of 96° sugar per ton of cane.

Another factory which handled a large amount of POJ cane with very little difficulty and with excellent results was the Reserve factory of Godchaux Sugars, Inc. Mr. J. P. GREVEN, the efficient Superintendent of Reserve Refinery, has kindly furnished us with the following data on some special cane tests made in that factory on the 30th of November. These figures, given in Table VII, need no comment.

CONCLUSION.

All evidence, therefore, would seem to point to the fact that no difficulty need be anticipated in the handling of POJ canes in the average, or even below the average, Louisiana mill. However, as the writer has contended all along, we must face the fact that, with canes of increased fibre content over those

TABLE VII.

Special Cane Test at Reserve Refinery, November 30th, 1927.

Cane	Analysis: Juice	Brix	Sucrose	Purity	Glucose	Bagasse: Sucrose	Moist.	Per Cent. Fibre in Cane.	Normal Extraction	Tons Cane per acre.	96° Sugar per ton.	96° Sugar per acre.
Purple Station	Crusher	13·42	10·16	75·71								
	Mixed	13·12	9·80	74·70		4·25	47·50	11·27	75·90	25·05	131·19	3286·3
	Residual	12·24	9·06	74·02	1·08							
POJ 234	Crusher	15·12	12·32	81·48								
	Mixed	15·02	11·76	78·30		4·39	48·80	13·84	69·37	30·93	147·97	4576·7
	Residual	14·44	10·51	72·78	0·769							
Purple Field Run	Crusher	13·32	9·85	73·95								
	Mixed	13·12	9·40	71·65		4·25	49·50	10·22	76·94	24·18	124·19	3002·9
	Residual	13·04	8·96	68·71	1·00							
POJ 213	Crusher	15·02	12·33	82·09								
	Mixed	14·62	11·61	79·41		4·39	43·80	13·32	73·44	37·57	155·90	5857·2
	Residual	14·14	10·27	72·63	0·847							
POJ 36	Crusher	14·92	11·60	77·75								
	Mixed	14·42	10·84	75·17		4·53	47·70	14·49	68·43	36·01	131·33	4729·2
	Residual	14·24	10·10	70·93	1·04							

NOTE.—Pounds 96° Sugar calculated on extraction shown by each variety and B.H.E. of 98, using Java Formula.
No maceration used on mill. Per cent. fibre in cane calculated.

we are accustomed to handling in those mills, our grinding capacity per day is bound to be reduced to a certain extent by the larger amount of fibre which the mills must handle per unit of time. Undoubtedly, now that sufficient cane for all our mills is in sight, we will want to increase capacity instead of going along with the same equipment and, therefore, reduced capacity over previous years. Judging from experience in Cuba, Peru, Hawaii, Porto Rico and the Philippines, one of the most efficient and at the same time economical means of obtaining more capacity is by securing a more even feed to the crusher through the use of some levelling device such as rotary knives. At the meeting of the International Society of Sugar Cane Technologists in Havana the opinion of many engineers from all over the world seemed to be unanimously in favour of the use of knives for this purpose. For instance, Mr. McAllep, the well-known authority from Hawaii, said at the meeting at the Section on Milling on the 15th of March,[1] "They give an even and steady feed of cane to the mills," while Mr. George W. Connon of the Honolulu Iron Works Company, made the statement: "Cane knives increase the extraction by ½ to 1 per cent., or in some cases even more. They are a decided benefit and I believe that in the near future they will be in quite common use." Mr. L. G. Camp, Consulting Engineer, of Havana, made the following statement : "A study of the work done by the several factories equipped with cane knives, as shown by the semi-monthly reports in determining capacity of the Cuba Sugar Club, suggested that cane knives may be considered as equivalent to one additional roller in the mill train. Or, in other words, they are equivalent to 50 per cent. of the crusher." Mr. Miguel Arango reported: "At Central Andorra, we were grinding about 150,000 arrobas. Since we installed cane knives, we grind 175,000 arrobas per day (92·4 short tons per hour). On the average less than 100 H.P. is used. The mills have been running much easier and we are now driving them slower because of the increased capacity." Mr. Semple, of the Mirrlees Watson Company, stated that "In Hawaii of the forty factories reported in the Annual Synopsis of Mills 31 are operating with knives." Mr. Del Valle of Porto Rico stated : "Knives were installed for the first time in Porto Rico this year in three factories, these factories having increased capacity by 15 to 20 per cent."

Lastly, in a compilation of the monthly reports for the Fifth Annual Convention of the Philippine Sugar Association, Mr. Theodore Nickelsen made the following mention of the value of knives which ought to point some lessons: "In many mills where overloading operation is the rule of the day the knives are used merely as a leveller helping to some extent the feeding of the crusher of the mill by taking care of the loose cane and preventing it from over-running the top roll of the crusher. Without knives to cut or pack the cane into a more compact form this over-running is considerable and is likely to curtail the feed. In the study of the work of a modern cane crushing plant, one fact predominates in the final analysis of comparison between the cane on the cars and the bagasse entering the furnaces and that is that the cane is disintegrated and the quantity of disintegration is measured by the greatest number, etc., of the intervening machinery units. Considering the foregoing, a conclusion is reached that any machine or machines that may help in this disintegration work is of practical value, irrespective of individual efficiency of the machine in question, when measured by its work in reducing the burden on the succeeding units of the mill in completing the disintegration proceedings. This holds good if the preparatory machine in its working

[1] Proceedings of the Second Conference of the International Society of Sugar Cane Technologists.

does not interfere with or cut down the amount of the material which the main units of the mill machine have to take care of in this final process of disintegration."

It would seem, then, that without any inordinately great expense we in Louisiana can not only nullify the decreased extraction due to the high fibre content of the POJ canes, but, by replacing some weak crushers with the large heavy duty type now so much in vogue the world over, we can considerably increase the capacity of our mills without any further great change in most of the houses, with the possible exception of the installation of an occasional pre-evaporator, where the increased capacity, obtained through better levelling and crushing, puts an undue strain on present boiling-house installations. All of these facts were largely demonstrated during the successful Louisiana crop last year, when fully 85 per cent. of the cane ground was of the high-fibred POJ varieties.

A Study of the Waste-Waters from Beet Sugar Factories and Suggestions for their Disposal.

By WALLACE MONTGOMERY, Assoc.M.I.Mech.E.

(*Continued from page* 549.)

Working under actual operating conditions in connexion with a beet sugar factory the following experiments were carried out to determine the best and most economical treatment necessary to render the large volume of factory wastes inocuous and to be able to dispose of them by discharging into rivers or streams without danger of pollution.

SCREENING EXPERIMENTS.

Two copper wire screens (40 and 100-mesh), as for sand analyses, having openings 0·46 and 0·158 mm. in diam., respectively were used. They were 8 in. in diam. and 2 in. deep, and so arranged that one fitted into the other, there being no chance of water leaking away between the two screens. A known amount of the waste was poured on to the 40-mesh screen and passed through both screens.

After pouring enough of the waste through the screens to obtain an appreciable amount of screenings, the latter were transferred to a graduate and the volume noted. They were weighed, and dried over night at about 95°C. under a vacuum of 27 to 28 in. After removal from the oven, they were again weighed, and finally measured in a graduate. The volume determinations were probably not very accurate, since it was difficult to compact all samples to the same degree in the graduate. It was also difficult to remove every particle from the screens.

In order to determine the effects of screening on the chemical composition of its different wastes, samples were taken of screened wastes at the same time the composition of the wastes was taken. The hourly portions were screened through a 40-mesh screen and collected in a gallon bottle. The results of these analyses are shown below, though they were so variable that they cannot be considered reliable, undoubtedly due to the difficulty of obtaining representative samples.

Factory Waste.—The waste for these experiments was taken at the point where they passed from the factory sewer to the open ditch. They not only contained the fluming water and floor and other wastes from the factory, but also the pulp water :—

Amount Waste Gallons	Vol. c.c.	Wt. Grms.	Screenings: 40 Mesh Screen: Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.	100 Mesh Screen: Vol. c.c.	Wt. Grms.	Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.
20 wet	75·0	61·4	4·8	6780		13·0	14·0	0·85	1545	
dry	36·0	7·8	2·4	862	87·4	6·5	3·4	0·43	375	75·8
14·6 wet	45·0	46·5	4·0	7050		12·0	12·9	1·07	1950	
	24·5	4·2	2·2	634	90·0	4·5	1·9	0·40	287	85·3
Average wet			4·4	6915				0·96	1748	
				748	88·7			0·42	331	80·5

The amount of solid material removed by this 40 mesh screen is 6915 lbs. per million gallons wet weight, or 748 lbs. per million gallons dry weight; or in parts per million, 830 and 90 for wet and dry respectively. The removal by the 100-mesh screen of material passing the 40-mesh screen was 1748 lbs. per million gallons of wet screening and 331 lbs. dry, or in parts per million, 39·7, or a removal of 5·1 per cent. of the total suspended matter. The total removal for both screens was 16·6 per cent. In the composite sample taken of this waste with the pulp water waste removed, the unscreened sample contained 780 parts per million of suspended matter and the screened 712, or a reduction of 8·7 per cent.

Pulp Water.—The waste for these experiments was collected at the point where the waste entered the main factory sewer. The results are shown in the following table :—

Amount Waste Gallons	Vol. c.c.	Wt. Grms.	Screenings: 40 Mesh Screen: Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.	100 Mesh Screen: Vol. c.c.	Wt. Grms.	Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.
6 wet	110·0	98·9	24·0	36,400		35·0	20·9	7·6	7680	
dry	45·0	3·1	9·8	1,140	96·8	13·0	4·1	2·8	1510	80·3
4 wet	115·0	98·0	37·8	54,200		7·5	6·1	2·4	3360	
dry	40·0	4·8	13·0	2,650	95·1	6·0	0·8	2·0	442	36·8
Average										
wet			30·9	45,300				5·0	5520	
dry			11·4	1,895	95·8			2·4	976	82·5

The amount of wet material removed by the 40-mesh screen averaged 45,300 lbs. per million gallons and the dry material 1895. The removal by the 100-mesh screen of material passing the 40-mesh screen averaged 5520 lbs. per million gallons wet and 976 lbs. dry. The total amount removed per 24 hours would be 956 lbs. wet or 168·8 lbs. dry. This is a much better removal than with the preceding waste as might be expected, as the suspended matter in this waste is composed of much larger particles, the greater portion of it being pieces of cossettes.

Silo Drainage Water.—Results of similar screening experiments with this waste are given below :—

Amount Waste Gallons	Vol. c.c.	Wt. Grms.	Screenings: 40 Mesh Screen: Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.	100 Mesh Screen: Vol. c.c.	Wt. Grms.	Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. moisture by wt.
8 wet	488·0	449·8	79·8	123,500		28·0	27·0	4·6	7450	
dry	175·0	25·9	28·6	7,150	94·2	3·5	1·7	0·57	469	93·7
8·1 wet	36·0	41·3	5·8	11,230		11·0	13·0	1·8	3550	
dry	22·0	7·1	3·5	1,938	82·8	7·5	5·9	1·2	1610	54·6
Average										
wet			42·8	67,370				3·2	5500	
dry			16·0	4,544	88·5			0·89	1040	74·2

The results from these two experiments illustrate the widely changing character of this waste. No really accurate statement can be made from these results as to how much solid matter could be removed daily by a screen and grit chamber.

Final Wastes.—These were collected from the main ditch, and screening tests show as follows :—

	Screenings — 40 Mesh Screen					100 Mesh Screen				
Amount Waste Gallons	Vol. c.c.	Wt. Grms.	Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.	Vol. c.c.	Wt. Grms.	Cu. yd. per mil. gal.	Wt. lb. mil. gal.	Per cent. Moisture by wt.
12 wet	42·0	43·9	4·9	8080	..	23·0	26·6	1·50	4880	..
dry	27·0	3·8	2·9	700	93·4	8·0	1·4	0·52	257	94.7
14·6 wet	35·0	37·5	3·1	5670	..	11·0	12·3	1·00	1860	..
dry	20·0	3·0	1·8	453	92·0	6·0	2·9	0·53	440	76.3
41·6 wet	130·0	125·0	4·1	6640	..	27·0	32·7	0·84	1730	..
dry	62·0	8·2	1·9	434	93·5	15·0	5·2	0·47	276	84·0
Average										
wet	..	..	4·0	6797	..	..	..	1·11	2823	..
dry	..	..	2·2	529	93·0	..	..	0·51	324	85·0

The amount of wet material removed by the 40-mesh screen averaged 6797 lbs. per million gallons or 529 on the dry basis. The average flow for 24 hours as determined by actual measurement was 3·56 million gallons per day. The total amount of screenings removed per day would be 24,200 lbs. wet or 1880 lbs. dry. The 100-mesh screen removed 2823 lbs. per million gallons wet or 324 lbs. on the dry basis, which material passed the 40-mesh screen. For 24 hours the amount removed would be 10,000 lbs. wet or 1150 lbs. dry. The total suspended matter as obtained from the composite sample was 584 equivalent to a daily amount of 17,300 lbs. on the dry basis. The amount that would be removed by a screen would be 1890 lbs. per day or 10·9 per cent.; and by a grit chamber, as represented by the 100-mesh screen, 1150 lbs. per day or 6·7 per cent., making a total removal of 17·6 per cent. Due to faulty sampling in the field or laboratory, the suspended matter of the screened composite sample taken was higher than in the unscreened sample, so no comparison can be made of the two methods of determination.

Acidity Tests.—Tests were made to determine any change in the acidity of the silo drainage and pulp waters on standing, the results being as follows :

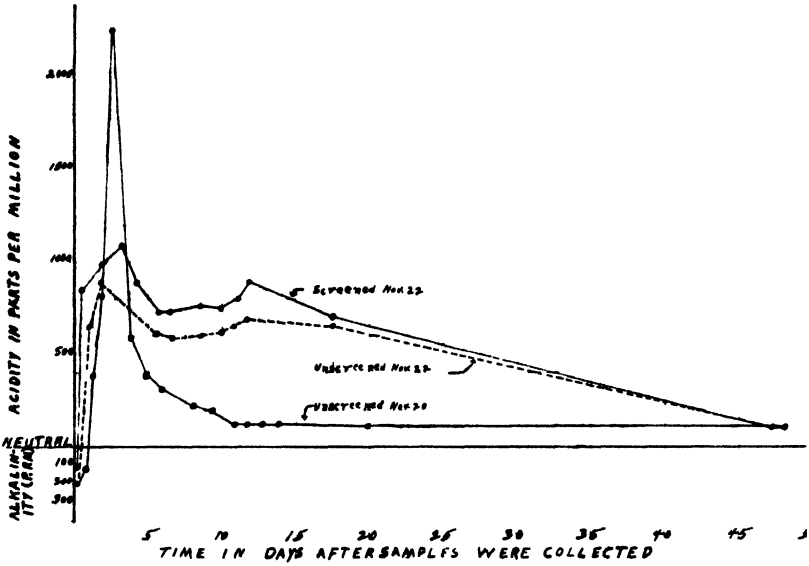
Date	Acidity Parts per Million
19	7120
20	7140
21	7180
22	7510
23	7970
24	8180
25	8000
26	6920

From the nature of the process of siloing, which is one of fermentation, it was to be expected that the acidity of the drain water would be high. For a week the acidity gradually increased, to be followed by a sudden drop of 1000 parts per million.

In order to present the variations in the acidity of these wastes more plainly, a graphical representation has been made, comparing the alkaline or acid contents with the length of standing. It is to be noted that the screened sewage became more strongly acid than the unscreened and remained so until after 47 days, when the acid content was the same in both. Another peculiarity is the slight increase in the acidity of the " date " 22 samples after ten day's

standing, followed by a gradual decrease. This increase was not noticeable in the sample dated 20. The matter of acidity is so complex and so many variables, such as sampling, temperature, organisms, are involved that it is not safe to make any definite statement as to whether this secondary increase is a normal phenomenon.

To sum up, these wastes when freshly produced are alkaline, but become acid with very great rapidity. Gradually the acid content decreases, but whether it finally disappears or not remains to be seen. After passing through



the silo the drainage water is much more strongly acid than the pulp water is at any time. In the silo the fermentation process proceeds under ideal conditions while in the pulp water much of the matter capable of fermenting has been removed.

Sedimentation in Imhoff Tubes.

Experiments were run on the silo drainage wastes and the final wastes to determine the possible settling of suspended matter, Imhoff tubes of 500 c.c. capacity being used :—

Time of settling. Minutes	Amount of settlings c.c.	Settleable solids cub. yd. per mil. gal.
Silo Wastes		
10	8	79·0
180	40	395·0
45	25	247·0
$14\frac{1}{3}$ hours	2	19·7
55	3	29·6
60	19	187·0
180	4	39·5
55	18	177·0
Final Wastes		
90	3·5	34·6
55	2·5	24·7
15 hours	3	29·6
120	2	19·7
120	2·5	24·7
Average		26·7

As in the other experiments, the changeable quality of the silo drainage wastes is very marked. The possible settling varies from 19·7 to 395·0 cub. yd. (wet) per million gallons. This variation is probably due to the removal of ensilage from the silo while these tests were being made. The dislodgment of cossettes caused many of them to fall into the drainage ditches and to be carried away. Owing to the great variation of the results, no attempt has been made to average these results or to determine the percentage of settling of the total suspended matter. On the final wastes the results give very consistent results. A settling of 26·7 cub. yd. (wet) per million gallons was obtained as the average of five tests. From the analysis of the chemical sample taken coincidently with these tests, the total suspended matter was found to be 584 parts per million, dry basis. In our screening experiment, the amount of water in the screenings was found to average about 93 per cent. With these figures as basis, the amount of settling figures ought to be 2340 lbs. (dry basis) per million gallons, or 280 parts per million. This is 48 per cent. of the total suspended matter. We have not figured on the total settleable solids, so cannot determine what the efficiency of this type of settling would be.

This suspended matter settles very quickly, there evidently being no need of long periods of sedimentation. These experiments would indicate that the efficiency of a sedimentation in Imhoff tanks would be much greater than a screen for preliminary treatment.

BIOLOGICAL OXYGEN DEMAND.

To obtain some information concerning the amount of dilution necessary to stabilize these wastes, an attempt was made to obtain the biological oxygen demand. The sodium nitrate process as described in the American Public Health Association methods was employed. It is probable that better results would have been obtained if the dilution of methylene blue had been employed instead. Owing to laboratory facilities, however, it was thought that the sodium nitrate method was the more feasible. Tests were made daily on the different wastes. A certain amount of sodium nitrate solution was added to bottles, two of which with different amounts were used for each waste on each day. Owing to the lack of information it was impossible to know just how high the amount of oxygen demand was going to run and it was largely a matter of guess work how much nitrate should be added. The results of these tests are shown in the following table :—

	Oxygen demand (p.p.m.)			Oxygen demand (p.p.m.)	
Time	Unscreened	Screened	Time	Unscreened	Screened
Condenser water before fluming			Silo Drainage wastes		
5-10 p.m.	78	—	3-10 p.m.	780	1060
11-55 a.m.	stable	—	11-45 a.m.	2640	2150
3-30 p.m.	stable	—	4-15 p.m.	2973	780
8-50 a.m.	stable	—	9-10 p.m.	5625	3275
Condenser water after fluming			Lime wastes		
3-30 p.m.	465	230	3-40 p.m.	285	—
11-55 p.m.	850	105	11-35 a.m.	22	—
3-30 p.m.	865	980	9-20 a.m.	stable	—
Pulp drainage water			Final Wastes		
2-30 p.m.	430	650	3-50 p.m.	175	770
3-40 p.m.	365	325	10-50 p.m.	795	619
8-50 a.m.	2806	1200	3-40 p.m.	stable	stable
			9-40 p.m.	150	130

As was to be expected, the condenser water before fluming in three out of four tests was stable, that is, a 100 per cent. relative stability value by the methylene blue test. On the other test the slight oxygen demand may have

been due to the passing over of some organic matter in the evaporators. The effect of fluming upon this water is well shown in the results obtained on the condenser water after fluming. The pulp drainage water shows a remarkably small demand in the first two tests. This may have been due to the fact that in the diffusion cells the cossettes are heated to a considerable degree with the killing off more or less of the biological life.

In making tests on the silo drainage wastes the samples were make alkaline to methyl orange and acid to phenolphthalein by addition of sodium carbonate. The wastes show a very high oxygen demand which is to be expected. The lime wastes show a small oxygen demand.

The demand of the final waste varies very considerably, but the demand is not excessive, being higher than ordinary domestic sewage but not as high as most industrial wastes. If the results of these tests are anywhere near reliable it may be safely said that the final wastes can be treated satisfactorily by any biological treatment. The effect of screening seems to vary considerably. In most cases the oxygen demand is lower on the unscreened sample.

HYDROGEN SULPHIDE.

The different wastes all show more or less hydrogen sulphide to be present, the silo drainage water being the highest, the pulp waste the next and the condenser water after fluming the least. The actual amount of hydrogen sulphide contributed to the final waste depends on the ratio of dilution of each waste with the total waste. The following table gives the approximate amounts of hydrogen sulphide in the final wastes in p.p.m. from the separate wastes :—

Waste	Hydrogen sulphide in total waste (p.p.m.)
Fluming	0·695
Pulp	2·44
Fluming and diffusion	3·14
Silo drainage water	1·54
Lime	0·28
Final	4·96

Even though the relative flows of the silo drainage water and pulp wastes water are low it appears that they are responsible more than any other waste for the hydrogen sulphide production, yet it is to be remembered that all wastes show hydrogen sulphide present.

The Nitrogen Content	Per cent. of Beet
N of insoluble proteids	0·012
Albuminoid NH_3	0·063
Nitrates	0·050
Amide and Free NH_3	0·069
Total	0·194

The following nitrogenous organic substances have been identified : Betaine, asparagine, glutamine, leucine, legumine, tyrosine, xanthine, guanine, hypoxanthine, adenine and carnine. Ammonia may appear from decomposition of arginine, guanidine, allantonine, vernine, vicine and alloxanthine. Additional substances are oxalic, formic, malonic, succinic, aconitic, tricarballicylic, oxycitric, malic and tartaric acids in the juice.

None of the proteids or compounds above mentioned have any combined sulphur. A slight presence of mineral sulphates is noted. It is evident therefore that large volumes of hydrogen sulphide cannot be produced by the breaking up of organic matter contained in the beet pulp of the wastes.

In general, hydrogen sulphide produced from the splitting up of organic matter occurs in cases where albumin or its products of decomposition such as mercaptan, amines, and skatol are present. Cystin, if present, might under severe fermentation produce hydrogen sulphide. This substance, however, has not yet been found present.

Another possibility may be that lactic acid fermentation may produce sodium lactate which in the presence of magnesium sulphate will produce hydrogen sulphide, thus :—

$$2C_3H_5O_3Na + 3\,MgSO_4 = 3\,MgCO_3 + Na_2CO_3 + 2\,CO_2 + 2\,H_2O + 3H_2S$$

(Sodium lactate)

Having noted the hydrogen sulphide content to be higher in the pulp waste and silo drainage water, both of which ferment rapidly, it may be possible that lactic acid is formed with production of hydrogen sulphide. However, this production depends on the mineral sulphate present in the water.

PROPOSED TREATMENT.

Separation of condenser, battery and silo wastes at the mill ; treatment of the condenser waters (after use for fluming of the beets) by fine screening and grit removal, cooling by means of spray towers, storing in reservoirs for re-use. Final disposal by irrigation of lands planted to alfalfa or other crops, utilizing the check method of application, with sub-surface pipe or surface ditch.

Advantages of Project : (1) That it affords a perfectly simple, direct and positive method of disposal of the mill wastes without danger of odours or nuisance of any kind. (2) That it makes direct use of two extremely valuable characteristics of the mill wastes ; namely, a large volume of water available for the irrigation of lands which are usually greatly in need of water and a content of organic and mineral matter which will add much needed humus and fertilizing ingredients to the soil. (3) That the greater value of the crops which can be raised on the lands will not only pay the cost of the project but will undoubtedly prove to be a source of considerable additional revenue. (4) That the land utilized under this project ought eventually to develop an abundant supply of humus and become rich and productive.

Disadvantages of Project.—These do not appear to be significant, considered either absolutely or relatively. The minor disadvantages are : (1) That if the wastes cannot be delivered by gravity to the suggested area they must be pumped—this requiring extra outlay in equipment and power. (2) That the cost of preparation of the land for irrigation and the cost of the necessary distribution pipe and ditch systems will be considerable ; but it is to be observed that this work would permanently enhance the value of the land and would undoubtedly prove to be a good investment. (3) That the use of the waste-waters will infect the land with nematodes, unless chlorination is applied, which is somewhat costly.

Feasibility of Method.—This method almost unquestionably offers an extremely simple, direct and reasonable solution of the problem of waste disposal. It would be sanitary and inoffensive. Instead of being a source of expense, it should produce a considerable net profit over and above the cost of the works and their operation and the value of the crops now raised on the lands to be irrigated. It must be concluded, therefore, that this method is expedient and worthy of detailed consideration to any particular factory for which there may be prepared cost estimates.

The writer is indebted to Messrs. GUTH, WADE and BINKLEY for many of the tests and analyses referred to in this article, as well as for assistance in preparing same.

Recent Work in Cane Agriculture.

NOTES ON INSECTS DAMAGING SUGAR CANE IN QUEENSLAND. **Edmund Jarvis.** Bulletin No. 3 (Second Edition, revised), 1927. Division of Entomology, Bureau of Sugar Experiment Stations, Queensland.

Although it may be technically correct to describe this publication as a second edition, it would, we think, have been simpler to give it a new number and thus bring it into line with other recent developments of the subject : it is, to all intents and purposes, a new publication. Bulletin No. 3 was issued in 1916,[1] and is stated to be " a brief record of field and other observations, made during about twelve months and confined almost exclusively to a very limited area within two miles radius of Gordonvale," where the entomological laboratory was then situated. The present bulletin has a much wider scope, although still chiefly confined to the northern, Cairns, district of the Queensland sugar belt, and incorporates the results of a dozen years of strenuous work in field and laboratory.

There are, in consequence, many differences between the two. It is not surprising to note that the number of pages has been doubled and, although the Plates have been limited to seven in each issue, many text illustrations have been added, and the Plates themselves considerably altered. On the other hand, the number of cane pests mentioned does not appear to have greatly increased, being 53 in the first and 63 in the second edition ; but there are many differences in the treatment of these. In the first bulletin the descriptive portion includes the whole of the 53 pests, whereas only 44 are thus treated in the second, the remaining 19 being merely listed as attacking the cane, but of negligible economic importance. This arrangement indicates a much larger knowledge of the status of the pests ; but an attempt on the part of the reviewer, to analyse any changes in the relative importance of individual pests during the dozen years, was frustrated by alterations in nomenclature and in arrangement. For a comparison of the two bulletins, it has therefore been considered more appropriate to take one insect, and discuss the methods of control recommended in the two issues, and for this purpose a pest of major importance has been selected, *Lepidiota albohirta* (*Lepidoderma* in the later edition), whose grubs with those of its allies are known locally as " white grub." It was, presumably, owing to the inroads of this beetle that the entomological section of the Bureau was started in the first instance, for it has been and is by far the most troublesome in this northern, tropical, portion of the cane belt. It has been strenuously fought against since the commencement of the industry, and its study will provide a useful estimate of the progress which has been made in entomological research and practice, during the period between the two bulletins.

The collection of the beetles at swarming time is probably the oldest form of control practised, and this is recommended in both bulletins, but there is comparatively little else in common. An illuminating statement of the life cycles of the insect is added in the second bulletin. Favourite feeding trees were known in 1916, and these were sprayed with " stomach poisons " : e.g., with a mixture made up on the 2 : 50 : 1 formula, that is, 2 lbs. of arsenate of lead, 50 gallons of water and 1 lb. of molasses. This treatment is omitted in the second bulletin, but it is recommended that such favourite food plants as *Ficus pilosa* and *F. Benjamini* should be planted every few hundreds of feet along the headlands. In the early dawn, the beetles are found resting on the trees in a semi-torpid, sleepy state, and shaking or jarring the trees will cause them to fall in an inactive condition, when they can be gathered into sacks.

[1] See *I.S.J.*, 1916, 365-369 and 426-427.

Another line of collection is also advocated, in constant clean cultivation of the cane rows and unplanted areas near, especially during the egg-laying period. This should be continued for at least one month after the first flight of beetles has been noted. In badly infested tracts it is recommended that boys should follow the ploughs and pick up the grubs and beetles, then near to the surface and turned up during ploughing. The author observes that "this form of control is kept up in most sugar growing countries: notably in Porto Rico, where collecting the grubs and beetles of Phyllophaga is reported by experts to be the only sure way of keeping this pest from increasing."

Attention is drawn in the earlier bulletin to experiments then recently conducted with "dichlorbenzole," as a deterrent, while in 1927 this treatment had passed the experimental stage, and clear-cut directions are given regarding fumigation, with both "paradichlor" and carbon bisulphide.

A list is given of six insect enemies of the white grub as known in 1916, and this portion of the subject of control is left at that. In 1927, the whole subject of natural enemies of the white grub and the controlling treatment of the cane fields for the protection of these enemies is somewhat fully discussed. Among the "farmer's friends" deserving protection are mentioned several birds, the common bandicoot, the lesser flying opossum and three species of digger wasps, besides one or two others. Leaving undisturbed or planting such weed plants as *Sida cordifolia* and *S. acuta* is recommended wherever possible, as these provide honey of which the female digger wasps are extremely fond. And a concluding section is devoted to "Insect friends of the cane grower": four maggots, cocoons, etc., are described in simple language, and it is advised that these should be left undisturbed in field work: a parasitic fungus, *Metarrhizium anisopliae*, is also mentioned and described, as destroying the grubs in the autumn months and covering them with a greenish crust composed of spore masses.

The bulletin is packed with information as to the pests in the cane fields in North Queensland, and the best methods at present known of dealing with them —the majority of the latter having been found to be thoroughly effective in laboratory and practical field tests. Needless to say, the descriptions of the insects are shorn of all unnecessary technicalities, while a fairly comprehensive glossary is included of such as have become unavoidable. The general appearance and coloration of the insects in different stages of development receive special attention; these can be seen by the naked eye. Details respecting the "puncturation, sculpture, scales, anatomical structure, etc., can be observed, for the most part, with a pocket lens magnifying about ten times." This bulletin should be widely welcomed by the more intelligent of the cane farmers, and should provide them with interesting reading, besides enabling them to distinguish between the cane pests and their antagonists in the fields.

GROWTH MEASUREMENTS OF CANE AND THEIR USES IN COMPARING CULTIVATION PRACTICES. **A. Lee and R. C. Pitcairn.** Committee Reports for the Sixth Annual Convention of the Philippine Sugar Association, September, 1928.

The authors urge the value of periodically recording the growth in length of the canes in the field, for assistance in making crop estimates, correlations between weather and growth, judging the value of different treatments, and field observations generally. As an example, curves are plotted showing the

growth of Negros Purple, J 247, Badila and DI 52 during fortnightly periods, from March to September, with details of the rainfall during the same periods. This experiment was conducted in the lowlands (Hda. Tanza).

According to the chart, Badila alone appears to have suffered a check during the fortnight from May 28th to June 11th, and the authors are unable to account for this : " it cannot be due to the weather, since none of the other canes showed any unfavourable reaction," and some inefficient cultivation procedure is suggested in the Badila field. But an inspection of the rainfall recorded on the chart arouses the suspicion, from what follows, that nearly 9 cm. of rainfall during the preceding fortnight may have proved inconvenient to canes less than four months old. However that may be, a month later heavy rains set in : 15·47 cm., 22·57 cm. and 27·25 cm. in the fortnights from June 25th to August 6th. Badila suffered a smart check in growth from July 23rd to August 6th, and Negros Purple a similar check a fortnight later, while J 247 showed less retardation and DI 52 was only slightly affected. The growth of Negros Purple up to September 4th was only 42 in., Badila 60 in. and the other two 70 in. or over. The authors accordingly suggest that growing the first named under Tanza conditions is inadvisable.

A second chart records curves of growth, in the uplands (at Hda. Hansiguinon), of Negros Purple, Badila, DI 52, Hambledon and Rose Bamboo, during the same period, but without details as to the rainfall. The growth of these canes was more uniform, Rose Bamboo leading with 80 in., Badila last with 60 in., while the rest were intermediate. " One is somewhat surprised to note a check in growth coincident with the heavy rains of late July, similar to the check in the lowland, although not so severe . . . . Negros Purple and Badila suffered much less, although DI 52 suffered more."

A third chart records the growth of Badila (at Bacolod-Murcia) with *cagaycay* (lime shell) and without. The curves are very close together, but show a slight increase in growth after June in the treated plot. The retardation in growth after the heavy rains after June 23rd, as shown in the chart, is much less pronounced than in the former chart, although more rain fell.

The method of measurement was, as usual, from ground level to the highest visible leaf-joint. A well-deserved tribute is paid to the work of W. P. ALEXANDER in Hawaii, in utilizing these measurements in his field observations ; but it must not be forgotten, as the authors appear to do, that the credit of fixing the topmost visible leaf joint of the cane plant in stem measurements is due to KAMERLING in Java, who in 1904, after a laborious study of the growth periods of the leaf, leaf sheath and stem of the cane, fixed upon this point as indicating the rate at which the cane stem was growing.[1]

C. A. B.

*** On page 409 (*I.S.J.*, 1929) under " Recent Agriculture," some doubt was thrown on Follett-Smith's statement that in sub-dividing limestone so as to pass through a sieve with meshes ten times smaller, the total surface area was only increased ten times. This figure is, however, correct. The sum is easy, though with pitfalls in memory working. The number of particles is increased 1,000 times and the surface area of each is decreased 100 times : hence the total surface area is increased ten times. A clay soil has 500 times the surface area of a coarse sand.—C. A. B.

[1] See Studies in Indian Sugar Canes, No. 5, *Mem. Dep. India, Bot. Ser.* Vol. X., No. 3, August, 1910, where the whole question is gone into and KAMERLING'S contribution briefly summarized.

Java Technical Notes.

CORROSION OF SOEMBERDADI'S EVAPORATOR TUBES. **T. van der Linden.** *Archief Verslagen*, 1929, Afl., No. 3, 116-121.

Soemberdadi s.f. of the H.V.A. had scarcely ground three weeks when it was found that several tubes of the 2nd body of the evaporator had sprung leaks, and no sooner had these tubes been stopped off than others were reported to be in the same condition. All these tubes had cracked through about 10 cms. (4 in.) below the tube-plate and were moreover strongly corroded. It was necessary to replace all the 1800 tubes of the 2nd body, a stoppage of four days being thus caused. Tubes of the 1st body showed no trace of corrosion; there was a little in the 3rd, and practically none in the 4th. At once an investigation into the reason of this extraordinary occurrence was instituted. Analyses of the tubes proved that their composition came up to specification (marine metal, 70 Cu : 29 *Zn* : 1 Sn); but in the scrapings from the corroded parts, a dark-blue powder, much sulphur was found. It was present neither as sulphite nor as sulphate, but as sulphide. That the corrosion was due to over-sulphitation appeared very unlikely, chemical control figures disproving this, the *pH* of the evaporator condensed waters being as usual, viz., about 8·4. It was thought to be due to the incondensible gases, mainly to sulphuretted hydrogen, this being borne out by the fact that the worst corrosion had taken place at the top of the tubes just below the upper tube-plate. Besides the copper sulphide in the scrapings, there were also oxides, leading to the deduction that in addition to H_2S (sulphuretted hydrogen), the other incondensible gases, viz., air, ammonia and carbon dioxide (or rather ammonium carbonate), had played some part. But where had the H_2S come from? Clarified juice, filter-press juice and filter-press washings were distilled, and H_2S was found in the distillate from the last mentioned. It moreover darkened lead acetate paper, a test for H_2S. After further investigation, the conclusion arrived at was that H_2S had been formed in the settlings, as the result of the action of micro-organisms, which had fermented protein substances containing sulphur. Steps were consequently taken to stop this condition of affairs. In addition to the disinfection of the fore-factory, the mills in particular being well washed down, the settlings were sterilized by heating them up, as was also the juice from the filter-presses, and generally precautions were taken to arrest and prevent the sulphide fermentation which had wrought such mischief. This had the desired effect. H_2S formation was reduced to a minimum, and at the end of the season no evaporator tubes showed any corrosion. A final point made by Dr. VAN DER LINDEN is that metallographic and other physical tests made at the Technical High-school at Bandoeng showed no differences between the corroded and the uncorroded tubes. Therefore, there was no evidence that the structure of the tubes had at all aided the corrosion.[1]

CONTINUOUS BOILING OF SYRUPS. **P. Honig and W. F. Alewijn.** *Archief, deel III, Mededeelingen*, 1929, No. 17, 944-947.

More than 25 years ago ABRAHAM[2] carried out experiments on the continuous boiling of syrups, using a horizontal vacuum pan, but due to difficulty in regulating the process of crystallization his results were negative. Prof. SUJEW 10 years later[3] postulated theroetical principles according to which the problem might be solved. He pointed out that the formation of new crystals occurred mainly in the upper layers of the massecuite in the vacuum pan, a supersaturated condition being caused by the lighter syrup being

[1] *Cf.*, *I.S.J.*, 1927, 418. [2] *Centr. Zuckerind.*, 1923-24, 1283.
[3] *Enzyklopädie der Zuckerfabrication* (in Russian), Bd., IV, 157-158.

drawn in, new grain thus separating. Although the small crystals forming above are at first inclined to sink as the result of the difference in their specific gravity compared with the syrup surrounding them, they are prevented from so doing by the steam bubbles rising from below. These small crystals growing in the top layers, however, gradually become larger and heavier, their crystal surface in relation to their weight diminishing, so that they fall away to a lower zone of the vacuum pan. In each lower zone the quotient of purity is progressively diminished, and in consequence the tendency to secondary crystallization is also lessened, besides which the temperature is higher than above and the supersaturation is lowered. Hence one has the conditions for continuous crystallization if the massecuite be gradually drawn out of the pan from below into a crystallizer and care be taken not to mix the hot massecuite with the colder. Working with these ideas, WOSTOKOW in 1913-14 in the Sugar Experimental Laboratory of the Technical High School, at Charkow, U.S.S.R., carried out practical tests in collaboration with students. In the first which lasted 36 hours, 250 kg. of 1st product massecuite of 92·7° purity was boiled continuously, remaining 2½ hours in the vacuum pan and 5 hours in the crystallizer. Massecuite containing 60 per cent. of crystal was obtained, mostly large, with a little conglomerate grain. Later, 400 kilos. of 2nd massecuite was boiled continuously during six days, and the result was grain that did not differ from that obtained in the ordinary way. In 1925 the work was repeated on a larger scale, using a normal vacuum pan, 2m. diam., and 3½ m. high, and provided with a conical bottom which was connected through a pipe 0·7 m. diam. and 5½ m. long with a horizontal crystallizer, 1½ m. diam. and 3 m. long. Regarding the heating surface, this was 30 sq. m. in calandria and 5 sq. m. in double-bottom, steam at 2½ atmos. being employed. A vacuum of 60 cm. was used, and the temperature of the cuite was 75°C., which was later cooled to 50°C., the syrup drawn in being heated to 75-80°C. A nice massecuite was obtained; it had a Brix of 93·2 with a purity of 80·9, and gave a molasses of 60·1 purity. The sugar was coarse to medium, and no crystals smaller than 1 mm. × 1 mm. were present. The test lasted eight days, and 65 hl. of massecuite were spun per day. SUJEW finally calculated that in continuous boiling the capacity of the pan may be 25 per cent. less and that of the crystallizer 50 per cent. less than in present practice. According to these investigations, one may perhaps consider the continuous boiling of beet syrups to be solved. Whether cane syrups can also be exhausted according to the new method with the production of a proper sugar is for the future to show.

MILLING INSTALLATIONS IN JAVA. **H. A. C. van der Jagt.** *Verslag eener Reis ter Bestudeering der Suiker-industrie op Java,* 62-74.

This is the continuation of the author's account of his re-visit to Java after an absence of 16 years.[1] He was struck with the much greater quantity of cane now passed through the mills, though the actual number of revolutions per minute of the rollers is no greater than formerly. Randoe-Goenting factory, for example, with its crusher and four mills, of only 30 in. × 60 in., grinds 25,000 piculs per day with the thickest layer of bagasse on the carriers in Java, whereas 16 years ago such an installation would have been regarded as wonderful if it had dealt with 16,000 piculs. This result has been realized by the addition of more units in the installation, feed rollers, rake carriers, and especially by the improved composition of the roller metal. One of the principal figures for controlling the work of milling is the quantity of the juice

[1] See also *I.S.J.*, 1929, 438, 550.

lost in the final bagasse per 100 of fibre. By means of a formula, the quantity of diluted juice calculated on the original undiluted juice with the same dry substance content as the first mill juice. Hence the less juice one loses in the last bagasse, and the higher the figure for the extraction, the more efficient is the work of the mills. Some results taken from the mutual control figures for 1927 are as follows :—

Installation.	Lost Juice.	Extraction.	Maceration per 100 of Fibre	Number of Installations.
Three mills	58	91·2	127	15
Crusher and three mills	49	93·0	126	11
Four mills with maceration	18	96·7	147	1
Four mills	40	94 6	134	37
Crusher and four mills	39	94·7	140	102
Crusher and four mills and maceration	38	95·3	144	2
Five mills	32	95·7	145	9
Crusher and five mills	32	95·9	155	8
Crusher and five mills and maceration	19	—	—	1
Total number of installations				186

Most installations operating in Java consist of a crusher and four mills, and factories have gradually during the past few years gone over to this type of plant, so that in 1923, 1924, 1925, 1926 and 1927, the numbers adopting it were 53, 70, 89, 98 and 102. Searby shredders, Messchaert grooves and Meinecke carriers are now found in many Javan factories. An innovation is the juice-lift, operating on the same lines as the "Mammoeth" pump of the beet industry, being now in use in Java for the transport of juice containing *bagacillo* and other insoluble matter. It consists of a long U-tube having one leg longer than the other, the difference in length representing the height through which the juice is to be lifted. Sieving apparatus, operated entirely mechanically, is in general use, and in some factories all parts with which the juice comes into contact, as bed plates, gutters, shaking sieves, and storage tanks, are made of copper or bronze, it being found that in this way souring and the development of bacteria are retarded. Possibly this may be due to the acid juice dissolving traces of copper exerting an antiseptic effect, but it is also due to the smooth surface of the metal, which presents very much less opportunity for the micro-organisms to form colonies.

MISCELLANEOUS.

MICRO-ORGANISMS AT THE MILL. **F. E. Raabe.** *Archief, Verslagen*, 1929, Afl. 2, 38-39. Micro-organisms capable of decomposing sugar were found to be present in sound cane. Determinations were made of the acidity of the third and fourth mill juices ; and, contrary to what NIELSEN had found, the titrimetric acidity of the fourth was greater than that of the third, though the *pH* of the two was the same. After disinfecting the mill, the number of micro-organisms per c.c. in the fourth mill juice was determined and found to be 350,000, which figure rose to 1,000,000 four days afterwards.—OILY DEPOSITS ON EVAPORATOR TUBES. **W. J. M. Michielsen.** *Ibid.*, 53-54. Two tubes which had become fouled on their steam-side had been sent to the Experiment Station, the oily constituents in the deposit being found to amount to 18 and 34 per cent. But what was remarkable was the result for the transmission of heat before and after cleaning, it being stated that the figure for the dirty tube was higher than for the one which had been cleaned with solvent. Mr. H. J. SPOELSTRA, of the E.S., who had been responsible

for the transmission determinations, amplified this by saying that he had found benzine cleaning to be insufficient, in fact it appeared further to foul the tubes. In his opinion mechanical cleaning is to be preferred to the use of solvents which leave behind a thin layer of oily matter having a considerable effect on the transmission figure.—SWEETLAND AND VALLEZ FILTER TRIALS. **W. C. Bedding.** *Ibid.*, 60-61. After comparative trials at the Tandjong Modjo factory with Sweetland and Vallez filters on first carbonatation juice, the latter was chosen. Using Palma-twill cloth, the Sweetland had a capacity including dead-time of about 4 hl./m²/hour ; and the Vallez using drill and K 18, one about 10 per cent. less, the difference between the two being however, ascribed to the nature of the cloth. A Vallez filter costs about f. 8400, c.i.f., about half the price of the Sweetland.—BOILERS. **G. J. Schott.** *Archief, deel III, Mededeelingen,* 1929, No. 18, 949-1008. Statistics are given for 1925 and 1929, these concerning 1227 and 1309 boilers representing 301,022 and 343,436 sq. m. heating surface respectively. Of the 1309 boilers existing in 1929, the principal suppliers were : Stork, 388 ; Halle, 110 ; Werkspoor, 126 ; Petry Dereux, 94 ; Piedboeuf, 50 ; Maxwell, 44 ; Borsig, 37 ; Fives-Lille, 26 ; Breitfeld Danek, 25 ; Breda, 34 ; Babcock & Wilcox, 16 ; Ruston, Hornsby & Proctor, 12 ; Fletcher, 5 ; Aitken, 3; Thomson, 3 ; and Campbell & Calderwood, 1. Of the 1309 boilers 1220 were fire-tubes of one type or other ; 232 had a working steam pressure in kg. per sq. cm. of 6-7 ; 333 of 7½ ; and 568 of 8 ; 23 of 12 and 19 of 10, 28 not being recorded. There were 446 having a heating surface of 250-259 ; 90 of 260-269 and 389 of 300-309. During 1928 there were 19 economizers in use, these being furnished by Green, Dürr, Linke Hoffman. and Hartmann. Data are given for the boiler and furnace installations of all the Java factories.

Beet Agricultural Notes.

ROTHAMSTED FERTILIZER TRIALS.

Purpose of Trials.—The Anglo-Dutch Group generously made grants in 1927, 1928 and 1929, enabling extensive fertilizer trials to be made at Rothamsted and Woburn, and elsewhere.[1] These trials have brought out important points, but they have also shown that we do not yet properly understand the manuring of sugar beet and, therefore, are not obtaining as large yields as we ought. The Continental recommendations which most farmers follow are not altogether suitable to English conditions.

In 1927, sowing was unavoidably delayed at Rothamsted and the purpose of the experiment was to discover whether in these conditions, which are always liable to arise in a heavy soil, any fertilizer scheme could make up for lost time. Unfortunately, none of the forms, or combinations of nitrogen, potash or phosphate proved successful, and we do not yet know how to get over the difficulties of late sowing. The other experiments of 1927 and those of 1928 were to discover the effects of the various fertilizers on the crop, both on roots and leaves, the latter being important as stock-food.

Results.—The leaves behave normally towards fertilizers. Nitrogenous fertilizers deepen their colour and increase their size : an additional hundredweight of nitrate of soda gave about one ton of additional leaf per acre.

The roots, however, are much less affected than the leaves and are not nearly so responsive as mangolds. One ton of mangold leaf will commonly

[1] Rothamsted Experimental Station, Harpenden, Report. 1927-28.

give about 4 to 6 tons of root, but 1 ton of sugar beet leaf may give only 1 ton of root and sometimes much less. Sulphate of ammonia applied with the seed had but little effect : muriate of ammonia was rather better, but nitrate of soda was best of all. None of the nitrogenous fertilizers, however, did much to increase the yield, while they all lowered the sugar content and the weight of root formed per 100 parts of leaf. Phosphate had but little effect either on yield or sugar content. Potassic fertilizers also had only little action.

The results suggest that sodium, perhaps magnesium and chlorine, play some part in the nutrition of the sugar beet, and that the plant cannot make full growth unless they are supplied. Nitrogenous manure lowered the efficiency of the leaf as a producer of root.

Our present varieties come from the Continent, and in the long continued process of selection the search has been for roots rich in sugar suitable for the factory, but not necessarily for the farmers. As compared with the sugar beet grown sixty years ago at Rothamsted, the 1928 roots are much richer in sugar (17·6 against 11 per cent.), but the yield per acre, both of roots and of sugar, has decreased (33·1 against 41·6 cwt. per cent.), and the efficiency of the leaves has fallen considerably. The improvement has apparently been mainly a shrinkage in size of the root, thus compacting the sugar into a smaller space.

Apparently there is room for considerable improvement, both in varieties and in management of this crop, the restricted response to fertilizers suggesting some kind of congestion in the plant ; it is not always obtained : for example, at one of the outside centres (Durham) muriate of potash was distinctly effective, the yields being in tons per acre :—

No Potash	Muriate of Potash, cwt. per acre.		
	1	1½	2
9·75 ..	10·25 ..	10·87	12·32

Each plot also received 1 cwt. of ammonia and 4 cwt. super-phosphate per acre.
Increase per cwt. muriate of potash—20 cwt. sugar beet.

It is somewhat curious that the factory determinations of the percentage of sugar in the roots were consistently lower than ours made on samples taken direct from the field.

YORKSHIRE BEET GROWING RECORDS.

A special investigation is being carried out in the Department of Agriculture of the Leeds University, and detailed costs and returns are now published for the years 1922 to 1928 inclusive, and are given on page 617.[1]

During the last four years the average cost of growing sugar beet on the farms under consideration averaged £17 per acre, and the sugar content 17 per cent. If the factory prices payable per acre on the agreed reduced scale for beet with sugar content of 17 for crops varying from 4 to 15 tons per acre are plotted against the average cost of growing the beet, it is found that a 7 ton crop with a 17 per cent. sugar content should just about hold its own during the next three years. A 10 ton crop might be expected to leave a net return in the growers' favour of £6 to £7 per acre.

In a favourable year (like 1926) yields of 8 tons may be expected. On the other hand, in a year as unfavourable as 1927 little more than half the growers may be expected to have their beet at a yield likely to do more than cover expenses. A graph can be plotted to show the various combinations of yield and sugar content required under the new prices to pay its way. Thus a 6 ton crop should not lose money if its sugar content were 19·2 per cent., and an 8 ton crop should be made to pay its way if its sugar content were to fall as low as 14·8 per cent.

[1] "The Economics of Sugar Beet Growing." Bulletin No. 161. The University, Leeds.

Sugar Beet.—Summary of Results.

	1922	1923	1924	1925			
Number of Crops	—	—	—	11	56	71	44
Acres covered	303¼	261	213	93	407	737	480
COSTS AND RETURNS PER ACRE.							
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Rent	1 9 6	1 10 6	1 10 0	1 7 9	1 9 5	1 9 2	1 11 8
Rates	0 7 3	0 4 2	0 4 7	0 7 9	0 6 6	0 6 1	0 6 2
Seed	0 9 3	0 9 1	0 7 3	0 8 6	0 7 10	0 7 8	0 7 10
Manure—F.Y.M.	5 16 8	6 17 5	8 13 7	2 14 3	1 2 8	1 2 5	0 17 11
Artificials	—			2 1 5	2 13 11	3 5 8	2 16 6
Standing Charges	2 3 1	1 13 3	1 14 11	1 4 2	1 1 7	1 0 0	1 0 3
Labour—Man	6 12 6	6 1 3	6 2 4	4 17 10	5 12 4	5 19 7	5 7 4
Horse	2 17 2	3 2 4	2 10 4	1 10 10	1 10 2	1 18 2	1 11 8
Tractor	1 9 8	0 3 7	0 6 4	0 3 0	0 0 11	0 0 4	0 1 0
Transport to Station	2 0 6	1 17 0	1 17 8	1 15 2	1 13 9	1 5 3	1 3 10
Rail Freightage	—	—	—	4 15 9	2 19 0	2 6 9	2 5 5
Growers' Representative	—	—	—	0 0 8	0 0 10	0 0 6	0 0 7
GROSS COST	23 5 7	21 18 7	23 7 0	21 7 1	18 18 11	19 1 7	17 10 2
Less Manurial and Cleaning Residue	0 12 10	0 16 1	0 18 9	2 15 10	2 0 5	2 8 1	1 5 6
NET COST AT FACTORY	22 12 9	21 2 6	22 8 3	18 11 3	16 18 6	16 13 6	16 4 8
Price paid by Factory	16 0 3	20 3 11	22 16 6	25 2 3	29 5 4	18 4 10	18 17 7
SURPLUS	—	—	0 8 3	6 11 0	12 6 10	1 11 4	2 12 11
DEFICIT	6 12 6	0 18 7	—	—	—	—	—
Yield of Clean Beet per acre	8t. 10c.	7t. 0c.	9t. 0c.	8t. 19c.	9t. 18c.	6t. 10c.	7t. 3c.
Sugar content	—	—	—	16·3%	17·7%	16·5%	17·2%
Lbs. dirt per cwt. gross	—	—	—	18	17	21	16·8
Cost of growing washed Beet per ton	£2 13 0	£3 0 6	£2 9 8	£2 1 5	£1 14 2	£2 11 6	£2 4 1
Price paid by Factory per ton	£1 18 11	£2 17 9	£2 10 7	£2 16 1	£2 18 11	£2 16 4	£2 11 4
SURPLUS per ton	—	—	£0 0 11	£0 14 8	£1 4 9	£0 4 10	£0 7 3
DEFICIT per ton	£0 14 1	£0 2 9	—	—	—	—	—
Production of white Sugar per acre of Beet	—	—	—	3,210 lbs.	3,900 lbs.	2,400 lbs.	2,813 lbs.

A summary emphasizing the main points of the results of this investigation includes the following points : Sugar beet can be grown on all but the heaviest soils, but thrives best on a deep, free-working loam. The width of the rows varies considerably, but the impression is that 21 in. or 22 in. rows give the most satisfactory results. As to whether beet should be grown on the ridge or flat, further evidence is necessary. Probably the former is the better, and this impression is confirmed by experiments carried out by other agriculturists. Very early drilling adversely affects the sugar content of the crop ; but singling should be carried out immediately the plants are big enough. The heavy application of farmyard manure is not necessarily an economic proposition. Returns show that the larger plots give a better net economic return to the grower, due largely to progressive economy in man, horse, and tractor labour, and in transport costs.

During the past five years there has been a steady increase in acreage under beet, marked by a considerable reduction in costs, with a good, but fluctuating return to the grower. With a subsidy remaining until 1933-34, and price uncertainties minimized, the crop offers a reasonable return to the grower for a number of years, assuming that the price paid by the factory for clean beet does not fall below, say, 50s. a ton. There is room for improvement in organizing deliveries at the factory, since long delays adversely affect the sugar content of the crop to the financial detriment of the grower. The failure of the crop to compete in the open market in 1922 was largely due to the heavy labour costs.

MISCELLANEOUS.

Beet Improvement.—ASA C. MAXSON[1] replies to the question why one cannot develop a single-germ seed-ball, thus doing away with hand-thinning. He says that the production of a single germ seed is comparable to securing a strain in which all the beets have 16 per cent. of sugar which seems impossible. After 50 to 75 years of intensive breeding, the average sugar per cent. has been raised to about 19 per cent., ranging from 14-15 to 21-22 per cent. After all, this range has not materially been raised over that of the wild beet, which may contain up to 14 per cent. of sugar. Nor can the natural range in the number of germs per seed-ball be raised. Another point is that the multiple seed-ball sends forth two or more plants, the combined power of which can break through the soil. when often one could not do so.

Cross cultivation.—JOHN COMER[2] states that his experience gained in the Fort Collins and Windsor territories of the U.S. leads him to believe that cross-cultivation has a future in connexion with sugar beet growing, for the reasons that it allows a field to be blocked at the proper stage, it speeds up the work of the beet labour, and it enables the field to be cleaned up well. In his experiments a new mechanical beet blocker (patent applied for) was successfully used. It is simple in construction and is said to have worked without difficulty in different kinds of fields. A drawing is given in the original article of the apparatus.

Cercospora.—Beets attacked by leaf spot disease yield less pure juices, have a lower sugar content,[3] and contain more amide and ammoniacal nitrogen than sound ones, requiring further the addition of soda ash in manufacture, and giving an increased amount of molasses. In Italy (where the disease is particularly active) soaking the seed in different preparations has proved fruitless. Dusting the leaves of the plant or better the soil with copper sulphate or copper preparation, has given the best preventive results.

---

[1] *Through the Leaves*, 1929, 17, No. 5, 275. [2] *Ibid.*, No. 7, 295-297.
[3] EM. SAILLARD in *Revue de Pathologie végétale et d'Entomologie Agricole*, 1928, 15, 10, 292.

Publications Received.

Die Zuckerfabrikation. J. Kucharenko, Professor at the Polytechnic and Agronomic Institute of Kiev, U.S.S.R. (Verlag Gustav Fock, Leipzig). 1929.

This is a handbook on new lines. It is described as a course of instruction for the manager of a beet sugar factory, and an aid in technical control. It consists in fact of a summary of important points concerning the practical working of the plant covering the entire range of manufacture, so as to secure the most satisfactory results. A publication in the same style, we are prompted to add, written for the use of the cane factory operator, summarizing necessary practical knowledge in as general a way as is possible for this to be done, is the type of book that would supply a need.

Volumetric Analysis. Dr. I. M. Kolthoff; with the collaboration of Dr. Ing. H. Menzel; translation by N. Howell Furman. Volume II; Practical Volumetric Analysis. (Chapman & Hall, Ltd., London). 1929. Price: 25s. net.

KOLTHOFF's work is very well known in its original German edition. This translation, however, is certain to be welcomed, as it concerns a publication that so far as this particular branch of chemical analysis is concerned is perhaps unexcelled in the wealth of critically tested methods which it contains. Almost every method of consequence which it describes has been practically tested by the author, and in addition the book contains many new procedures in volumetric analysis. It also has a particularly informative section on indicators, and this translation is provided with a good index, which was wanting in the original German edition. One of the methods that receive close attention is the iodometric titration of sugars by Schoorl's process.[1] BRUHN's copper titration is described,[2] as is also a modification of the author. The book is a valuable one without doubt, and this English edition will widen its sphere of usefulness.

Chemical Engineering Catalog, 1929. Fourteenth Annual Edition. (The Chemical Catalog Company, Inc., of 419, Fourth Avenue, New York. U.S.A.). Price: $3·00.

This Catalogue is the standard work of reference in the United States for those engaged in the chemical engineering industries.[3] It is an illustrated compilation of condensed catalogue data, being in fact "a roomful of individual catalogues, abstracted, indexed and assembled within the covers of a single book." It is published annually under the supervision of the American Institute of Chemical Engineers, the American Chemical Society, and the Society of Chemical Industry. It covers plant, raw material, and chemical products, and the thoroughness of its system of indexing names of firms and of material leaves nothing to be desired. It is a most excellent source of trade information for the field of industry with which it deals.

The Chemistry of Water and Sewage Treatment. Arthur M. Buswell. American Chemical Society, Monograph Series. (The Chemical Catalog Co., Inc., New York). 1928. Price: $7·00.

Those who may be concerned with the study of the treatment of beet factory effluents, distillery sludges, or other such wastes, will find this book a useful aid. It presents the information available concerning the chemical reactions taking place in the various processes by means of which water is improved for industrial or for domestic purposes or wastes are rendered fit for discharging into rivers or streams. Construction and operation of mechanical devices is not discussed in detail, this phase of the subject being touched on briefly and generally by means of diagrams and pictures of plants with short descriptions. Nor are analytical methods treated. But the range of information indicated is covered very completely, and the book is a welcome addition to the subject.

---

1 *I.S.J.*, 1916, 334; 1919, 578, 621. 2 *I.S.J.*, 1921, 230; 1922, 272.
3 See also *I.S.J.*, 1922, 604.

Brevities.

LECTURES ON TROPICAL HYGIENE.—The London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C., is giving a further course of lectures on Tropical Hygiene for men and women proceeding to the Tropics. These are to be held on December 4th to 13th inclusive.

INDIAN SUGAR COMMITTEE.—A Sugar committee has been appointed by the Imperial Council of Agricultural Research of India to advise on the steps that should be taken to assist the Indian sugar industry. Included in the personnel are Mr. B. C. Burt, Agricultural Expert Adviser to the Council, Mr. G. W. Clarke, of the Department of Agriculture, U.P., and Mr. T. S. Venkatraman, of Coimbatore.[1]

SUGAR IN BOLIVIA.—The Bolivian Government has lately provided for the creation of a national sugar industry, which is to enjoy exemption from National, State and municipal taxes on all importations of necessary machinery and supplies and no export duty will be levied on the sugar produced. Once production reaches the point where it will meet the domestic demand, it is stated that the present import duty on sugar will be raised considerably.

SUGAR IN THE CONGO.—A new sugar factory has been opened in the Congo district belonging to the Sucrière Congolaise at Moerbeke-Kwilu on the Matadi-Léopoldville Railway; this will produce direct consumption sugar. During 1929 over 700 hectares of land have been planted to cane and these have yielded an average of 13·17 per cent. sugar. For the first season the company expects to produce 2000 to 3000 tons of sugar, but by 1931 it is hoped to increase the output to 12,000 tons, as it has a concession amounting to 30,000 hectares, and the sole monopoly in sugar manufacture in a large district.

WORLD AGRICULTURAL TRACTOR TRIALS.—Under the auspices of the Royal Agricultural Society of England agricultural tractor trials are to be held next summer on land near Oxford. These trials will be open to machines manufactured in any country of the world, with no restriction as to weight or horse-power but limited to two machines of any one make or model; they will consist of two parts, (a) tests of a scientific and practical nature, not open to the public, and (b) a public demonstration. Details as to entry can be obtained from the Secretary of the above Society at 16, Bedford Square, London, W.C.1. The latest date of entry is December 31st, 1929.

BUENOS AYRES EXHIBITION, 1931.—It should not be overlooked by British Engineering firms that there is to be a British Empire Trade Exhibition at Buenos Ayres, Argentina, in 1931. The British Government propose to participate in this Exhibition and to house, in one of the finest buildings in the grounds, exhibits showing much of the development of our British Colonies and Protectorates. It may be worth the while of the British sugar machinery manufacturers to participate in this display of Empire products in the leading city of South America. The headquarters of the Exhibition authorities in this country are at 5, Parliament Mansions, London, S.W.1.

GERMANY'S BEET INDUSTRY.—At a recent meeting of the German Association of the Sugar Industry, the President, Director Aumuller, in referring to the contest of cane *versus* beet, urged State protection so that the industry should be able to supply the needs of the country at remunerative prices. Dr. Schultze said that if other countries than Java, particularly Cuba, were also able to reproduce colossal yields then the prediction of a speaker from Java at Geneva that European sugar factories must in 20 years close down would be realized. Prof. von Lippmann was not so pessimistic, pointing out that climatic and general conditions are altogether different in Cuba to what they are in Java, and the transformation suggested by the previous speaker was unlikely to come about rapidly. Prof. Krüger, who had himself taken part in cane selection work in Java, confirmed this, believing that for a long time yet cane and beet would continue to compete on the world's sugar markets. He insisted on the necessity of maintaining the German sugar industry by Customs protection as may be required.

[1] *Allahabad Pioneer.*

LINCOLNSHIRE SUGAR COMPANY.—The Lincolnshire Beet Sugar Company Ltd., which owns the Bardney factory, is changing its name to "Lincolnshire Sugar Company," doubtless with a view to emphasizing that its operations are not confined to beet sugar but take in the refining of cane as well.

NEW JAVA CANE.—Particulars are given by O. Posthumus[1] of a new Java cane originated from POJ 2878 and POJ 2940, seed cane of which will be submitted by the Experiment Station next January to estates for field tests to estimate its value compared with POJ 2878. So far, this new varieity has shown itself to be rather similar to POJ 2878. It is designated POJ 2961.

JAVA MOLASSES.—In a recent issue of our contemporary *Sugar News*[2] an interesting photograph is shown giving a bird's eye view of Soerabaja harbour with various depots of the Pure Cane Molasses Company with storage tanks. Another photograph shows the 14,000-ton molasses tanker, "Athelking" entering the harbour; and a third, one of the Java depots of the P.C.M. Co.

BEET PULP UTILIZATION.—By boiling beet pulp with water containing 0·1 per cent. of sulphuric acid for three to four hours one obtains an adhesive which advantageously replaces gum arabic. But by means of a more elaborate process,[3] involving dialysis, one can obtain a more concentrated product having adhesive qualities four to five times more powerful than gum arabic.[4]

POWER ALCOHOL.—In Queensland "Shellkol" (a blend of alcohol with Shell petrol) has met with success,[5] and road tests with different cars gave the following results: Whippet, "Shellkoll" 27·6 m.p.g., other spirit, 25·4; Chrysler (6 cyl.) "Shellkoll," 22·4 m.p.g., other spirit, 21·8; and Morris, "Shellkoll," 29·9 m.p.g., and other spirit, 26·4. The Queensland Railway has adopted "Shellkoll" for their petrol engines.

GLUTAMIC ACID.—Regarded in Europe and America as a rare chemical for use in research, and obtainable from beet molasses, in which it occurs to the extent of about 7 per cent. of the dry solids, glutamic acid costs about 1s. 6d. per gramme. It is surprising, therefore, to learn that in the form of its sodium salt it is used freely in the Far East as a condiment for imparting a meat-like flavour to the vegetarian diet of Buddhists, particularly in China. During the past eight years or so, it has been produced on a large scale with strict chemical control by the hydrolysis of proteins as gluten or soy bean.[6] It can be bought at the rate of about 8s. per lb.

GERMAN SUGAR INDUSTRY.—At a recent meeting of the German Association of the Sugar Industry, as reported in a recent number of its *Vereins-Zeitschrift*, a discussion took place on the possible future of the beet sugar industry. Mr. von Naerich expressed regret that in beet selection Germany had not made progress similar to Java in cane selection There appears no prospect, he said, of exceeding 18-20 per cent. of sugar, and it seemed impossible to regain the advance which had been made in Java. Dr. Spengler, Director of the Institute, on the other hand, was less pessimistic, remarking that they were not sleeping in Germany. On the occasion of a visit paid to a beet seed station he had seen some photographs of selected roots, the sucrose content of which was 27 per cent. This figure probably reached the physiological limit. Dr. H. Claassen observed that in Java it was not the sucrose content of the cane that had been raised, but the yield of cane per hectare which had been increased 40-50 per cent. It should be possible also in Germany to increase the sugar per hectare, and in fact by selection of the E-variety of beets higher yields had already been obtained. M. von Naerich, replying to Dr. Spengler, said that in his seed station he had many years ago met with roots of 21-22 per cent., but that it was the first time he had heard speak of 27 per cent.

1 *Indische Mercuur*, September 11th, 1929.
2 August, 1929.
3 *J. Fabr. Sucre*, 1929, No. 35, August 31st, 1929.
4 German Patent, by SMOLENSKI, 387,086 of 1923.
5 *Aust. Sugar J.*, 1929, 21, 218-219. 6 *Ind. & Chem. Eng.*, 1929, 21, No. 10,984-987.

Review of Current Technical Literature.[1]

Methods of Clarifying Sugar Solutions preparatory to Polarizing them. **M. I. Nakhmanovitch and S. L. Berman.** *Monograph[1] published by the Institute for the Sugar Industry, Kiev., U.S.S.R.*

This is probably the most complete summary of the literature of this phase of sugar analysis, one which has always attracted a great amount of attention among chemists; but it is possible here to give only some extracts from the principal conclusions stated by the authors:—The volume of the precipitate which forms on the addition of basic lead acetate to impure sugar solutions certainly influences the polarization, causing it to be higher, owing to the increased concentration of the sucrose. That the precipitate at the moment of its formation adsorbs part of the sugar, thus compensating for the increased concentration, has not been confirmed. When Horne's method of adding dry basic acetate is applied, addition of a large amount of reagent to the solution may decrease the polarization, this being explained by the dilution which is thus caused. It is very desirable that the method of preparing the basic lead acetate solution should be standardized, as at present a great number of formulae resulting in the preparation of solutions of differing basicity are used, these differing in their effect on the optically-active non-sugars. A freshly prepared basic lead acetate solution (other conditions being equal) effects a greater decolorization than one which has been kept for some time. Addition of basic lead acetate to impure sugar solutions causes a change in the rotation of the individual optically-active substances, due to partial decomposition of the compounds present; to the formation of lead saccharates and other insoluble lead compounds; and to the action of salts resulting from interaction with the clarifier. Dextrose is relatively stable in this respect, though in the presence of salts forming insoluble compounds with the basic lead acetate it is precipitated in part. But levulose in the presence of basic lead acetate is converted to dextro-rotary lead levulosate, which partly precipitates; neutral (normal) lead acetate does not modify the rotation of this sugar; and the addition of acetic acid will restore its original rotation. As yet the movement of pectin substances in the sugar-house and their relation to lead acetates has not been studied in the light of Ehrlich's recent work. Pectin and parapectin are removed from solution by basic but not by neutral lead acetate, and pectic acid is precipitated completely by basic lead acetate. Under the conditions of the inversion polarization, the pectin retains its dextro-rotation. The levorotation of aspartic acid is transformed in the presence of basic lead acetate to a dextro-rotation, which is increased in direct proportion to the amount of reagent added, but is restored to levorotation by the addition of acetic acid. In the case of dextro-rotatory glutamic acid the dextro-rotation is changed to a levorotation. Products of superheating are precipitated to a greater or less extent by basic lead acetate or neutral lead acetate, as are also some of the natural colouring substances. Later in this monograph, the authors deal with the use of basic lead nitrate (Herles reagent), activated carbons, oxidizing and reducing agents, etc., in the clarification of solutions for polarization.

Analysis of Massecuites, using the Refractometer. **D. Sidersky.** *Bull. Assoc. Chim. Sucr. Dist.*, 1929, **46**, No. 6, 272-277.

By examining massecuite in the refractometer, the refractometric index of the dry matter in solution in the mother-liquor is obtained, the crystals present not affecting the reading. Actually, however, the massecuite as such is not placed between the prisms of the instrument, as if this were done frequently the optical surface would soon be damaged. It is best to strain a little of the mother-liquor through some metal gauze, using a few drops of this for the test, which is made at the same temperature as that possessed by the massecuite. Secondly, one weighs out 10 grms. of the massecuite into a flask, with wide neck, adds 5-6 c.c. of boiling water to dissolve the crystals, cools, and re-weighs. After mixing the solution, it is observed in the refractometer to obtain the amount of dry substance present in the solution. If e is the water per cent. of the massecuite, and E is that of the mother

2 In Russian.

liquor, then $100e/E$ = the mother-liquor per cent. of the massecuite, and this subtracted from 100 gives the crystal sugar per cent. of the massecuite. Subtracting this latter from the polarization, one obtains the sugar in solution, per cent. of the massecuite. Having these data, it is easy to calculate the chemical composition of the mother-liquor and of the massecuite, as the following example will show: A massecuite contains 84·46 per cent. of total sugars and 2·19 per cent. of ash, 38·57 therefore is the saline coefficient or ash ratio. A double refractometric test as described gives e = 8·20, and E = 21·80, whence $100e/E$ = 820/21·8 = 37·61 mother-liquor per cent. massecuite, and 100 — 37·61 = 62·39 of crystal per cent. massecuite. Hence 84·46 — 62·39 = 22·07 sugar in solution per cent. of the massecuite. Dividing 100 by 37·61, one obtains 2·66 by which factor is multiplied the sugar in solution and the ash to convert them to percentages of the mother-liquor, obtaining altogether the following table :—

	Massecuite.	Mother-liquor.
Water	8·20	21·80
Sugar as crystal	62·39	—
Sugar in solution	22·07	58·70
Ash	2·19	5·83
Organic matter	5·15	13·67
	100·00	100·00
Quotient of purity	92·00	75·10
Saline coefficient (ash ratio)	38·57	10·07
Organic/Ash	2·35	2·35

These refractometric observations can be easily made and with great precision, though they demand some practice and a knowledge of the optical parts of the instrument, which is more sensitive than the saccharimeter. The refractometer has long been used in sugar factories and refineries in other countries, but insufficiently in France, and for the work described the total reflecting "Universal" type is recommended. Following the reading of this paper at the meeting of the Association of Sugar Chemists of France, the Chairman asked whether the interest in such methods resided especially in their rapidity, and Mr. SIDERSKY's reply was "Plus un essai est rapide, plus il est exact ; la précision est en inverse du temps passé à la manipulation."

CANE MOLASSES FERMENTATION : ADJUSTMENT OF ACIDITY (*pH*) FOR MAXIMUM ALCOHOL YIELDS. **F. M. Hildebrandt.**[1] *Ind. and Eng. Chem.*, 1929, **21**, No. 8, 779-780.

Concentration of solution, temperature of fermentation, and a supply of nutrients are known to have a bearing on the process of fermentation ; but it is necessary also to add acid (generally sulphuric) to the diluted molasses, in order to secure the maximum yield. The amount of acid should be carefully adjusted if the best alcohol yield is to be obtained. In the literature of the subject[2] amounts of acid varying from 1 gallon per 100 of mash to 10,000 of mash are recommended. A number of authors have reported on the optimum *pH* ; but there is considerable disagreement on this, the recommendations varying from 4·5 to 7·0 *pH*. It would seem that the quantity of acid necessary differs with various types of molasses, and even with successive shipments of a single type. A control method, therefore, would most logically be based on the setting of the *pH* of the mash to the point giving the highest alcohol yield. This can be done empirically by means of the small-scale fermentation tests, such a method now being described : Fermentation solutions made from cane molasses and water not sterilized, with no addition except sulphuric acid, were seeded with 2·5 per cent. by volume of a pure culture yeast grown in a sterilized molasses solution. Measurements of acidity were made with a quinhydrone electrode and a potentio-

[1] U.S. Industrial Alcohol Co., Baltimore, Md., U.S.A.

[2] References to former practice in regard to acid addition in fermentation are : Hawaiian Sugar Planters' Assocn., *Bull.* 28 ; *Louisiana Planter*, 68, 126, 206 (1922) ; HENNEBERG, "Gärungsbacteriologisches Praktikum," p. 188 ; EFFRONT-PRESCOTT, "Enzymes and Their Application," p. 89 ; *Bull. assoc. chim. sucr. dist.*, 31, 936 (1916).

meter, 10 c.c. of the mash being diluted to 100 c.c. with distilled water, quinhydrone added, and the reading taken. In the following table are shown some results (made in duplicate using Porto Rico molasses), in which the acid concentration is given as c.c. of 60°Bé. sulphuric per 1000 c.c. of fermentation solution, the "efficiency" being the percentage of theoretical yield on the basis of the total sugar :—

Flask	Acid Concn. c.c.	Sp. Gr. at Start ° Brix.	Acidity at Start *pH*	Acidity at End *pH*	Change in Acidity *pH*	Alcohol Per Cent.	Efficiency Per Cent.
1, 2	None	23·7	5·75	5·48	—0·27	8·5	83·7
3, 4	0·5	23·7	5·39	5·30	—0·09	8·6	84·8
5, 6	1·0	23·7	5·20	5·14	—0·06	8·7	85·9
7, 8	1·5	23·7	5·00	5·00	—	8·8	86·1
9, 10	2·0	23·7	4·80	4·80	—	8·8	86·1

These and other results indicated that if sufficient acid be added to make the *pH* 5·0 or lower, the fermentations do not drift toward the acid side from the beginning to the end, and that when the *pH* value does not drift towards the acid side the maximum yield is obtained. But the value of 5·0 *pH* is not to be regarded as a fixed point ; the real criterion for a solution optimum with respect to *H*-ions is that there is no tendency for the solution to show a lower *pH* at the end than at the beginning of the fermentation.

CAKED SUGAR PROBLEM AT EWA PLANTATION, T.H. **Ralph B. Johnson.** *Reports of the Association of Hawaiian Sugar Technologists*, 1929, 1-6. Previous to February, 1929, the normal method of drying and bagging was to drop the massecuite from pan to mixer, to pass immediately to the centrifugals, to wash with hot water, to discharge to a grasshopper conveyor, to take it to the Hersey dryers (where the fan and steam coils were not used), and then by way of a bucket elevator to dump the sugar into a hopper, from which it was automatically weighed and bagged for shipment. It is explained that the massecuite had a temperature about 70°C., which changed very little during the drying, leaving the centrifugals at about 55°C., the dryers at about 43°C., and entering the bags about 2°C. lower. It had a polarization of about 98°. Treated in this manner, many unfavourable reports were received from Crockett Refinery that the sugar caked. Caking is caused by the grains becoming cemented together by the very viscous molasses film about each crystal or to a partial crystallization which binds the grain together. Factors influencing this binding were found to be the temperature and the moisture content, this latter controlling the density of the molasses. Finally it was found that passing the sugar through a dryer with the fans working so as to draw cool air through the apparatus counter-currently effected a substantial improvement, which was completed by using cold water atomization in the dryer. Recommendations for making this high polarization sugar free-flowing are that it should be cooled so as to have a temperature no higher than 38°C. when bagged, and that its moisture content should be about 0·5 per cent. These remarks relate to sugar polarizing 98°C.

EFFECT OF PHOSPHATE CONTENT ON CANE JUICE CLARIFICATION. **P. L. Draeger.** *S.A. Sugar J.*, 1929, **13**, No. 6, 359-361. After describing the coeruleo-molybdate method of determining P_2O_5,[1] the writer says that at Illovo the best results are obtained by keeping the mixed juice at 0·035 grms. P_2O_5 per 100 c.c. ; under 0·030 per cent. the clarified juice is turbid and lacks sparkle, the settling and press stations being slowed down. Over 0·040 per cent., while giving a perfectly bright juice, yields settlings which are more voluminous and more flocculent, taking longer to subside, and slowing down the settling station, though the press work is not impaired. Apparently there is nothing to be gained by exceeding 0·035 per cent., but a cataphoresis apparatus and turbidimeter alone can prove this.—DETERMINATION OF FIBRE. **E. Haddon.** *S. A. Sugar J.*, 1929, **13**, No. 8, 477. Since the Java ratio is made use of to convert the sucrose per 100 grms. of juice to the sucrose per cent. cane, there is no serious reason why ratios should not be used to convert the Brix and purity of the first extracted juice to the Brix and purity of the normal juice, the

[1] See also FARNELL : *I.S.J.*, 1929, 149-151.

ratios recommended being 1·009 and 0·9845 for the two values respectively. An example is given of the method of calculating in this way the hydrated fibre, which in the case of Uba cane is found to be 20·42 per cent., giving a dry fibre content on a basis of 30 per cent. of colloid water of 15·70 per cent.—INVESTIGATION OF CANE MOLASSES DISTILLERY SLOP. **E. K. Nelson and C. A. Greenleaf.** *Ind. and Eng. Chem.*, 1929, **21**, No. 9, 857-859. An analysis was made of concentrated molasses slop as it came from a large alcohol distillery. Considerable quantities of formic, acetic, succinic, tricarballylic, and lactic acids, a small quantity of aconitic acid, and a possible trace of citric acid were found. No succinic and tricarballylic acids and only a little lactic acid were present originally in the molasses. The succinic acid and most of the lactic acid are evidently products of the fermentation. The disappearance of the greater part of the aconitic acid and its replacement by tricarballylic acid leads to the conclusion that, in the process of fermentation, the aconitic acid has been reduced to tricarballylic acid. Glycerol was identified, but the quantity was not large enough to make its extraction appear profitable.—FIBRE DETERMINATION BY CALCULATION. **R. M. Bechard.** *S.A. Sugar J.*, 1929, **13**, No. 9, 549-550. Referring to the proposal made by HADDON to calculate the fibre content of cane using Java, Brix and purity ratios,[1] this would not lead to reliable results, as a uniformity of fibre is presumed, which does not exist. With the ratios proposed, a high density cane would automatically have a high fibre. This is not necessarily the case. Lixiviation under standardized conditions is the only feasible method of arriving at the fibre in a sample of cane or bagasse.—INDUSTRIAL PRODUCTION OF ABSOLUTE ALCOHOL. **H. H. Bass.** *Australian Sugar J.*, 1929, **21**, No. 6, 375-376. Sarina Distillery, North Queensland (Australian National Power Alcohol Co., Ltd.), until recently produced the usual 96 per cent. spirit, by ordinary rectification, but the residual 4 per cent. of water, incapable of removal by repeated distillations, prevented the blending in of petrol or gas. But they have now installed a new plant which removes the last traces of alcohol at very little extra cost. It acts on the principle that when benzol is added to alcohol and water, and the mixture boiled, the hydrocarbon vapour forms a mixture with the water which can be boiled off, leaving behind 100 per cent. alcohol.[2] This absolute alcohol is mixed with petrol for the production of "Shell-kol" or similar fuel.—COLOUR PERCEPTION OF WORKERS IN SUGAR LABORATORIES. **R. H. King and G. A. Guanzon.** *Contribution from the Sugar Technology Department, College of Agriculture, University of the Philippines, P.I.* Students in the chemistry and sugar course at the College of Agriculture, Laguana, P.I., were examined as to colour perception, and found to exhibit a marked deficiency. Results obtained were such as to warrant one to expect that 10 per cent. of individuals working in routine in sugar laboratories are both colour blind and colour ignorant, 3 per cent. being colour blind. More care must be taken, it is concluded, in selecting workers, especially those likely to be engaged in colorimetric tests.—POTASH AND CHLORINE IN CRUSHER JUICES. **Geo. B. Glick.** *Reports of Association of Hawaiian Sugar Technologists*, 1929, 7-9. At Puunene they have never been able to find any relationship between the tons of cane per acre and the potash in the crusher juice, except in those cases where the potash is extremely high, where there is a drop in both tons of cane and sugar per acre. Best yields of sugar per acre have been obtained when the average potash and salt concentrations in the crusher juice were lowest.—BEARING JUICE RING AND GUARD. **A. W. Dunn.** *Ibid.*, 71-72. It is not uncommon to find journals of bottom rolls in service with only 25 per cent. of their original bearing areas remaining, due to erosion by juice and cush of the inner end of the shaft. To remedy this, the "Bearing Juice Ring and Guard" has been invented by the author. It is semi-circular, of angular form, and is superimposed on the journal box, fitting around the shaft journal. A counter-bore is provided in the ring for the retention of a packing conforming to the fillet of the shaft journal, this forming a tight joint. The guard member is secured to the mill housing, and fits fairly loosely over the ring member. This ring is used in addition to the customary form of roller juice ring. It is sold by the Farrel-Birmingham Company, Inc.

J. P. O.

---

[1] See above.

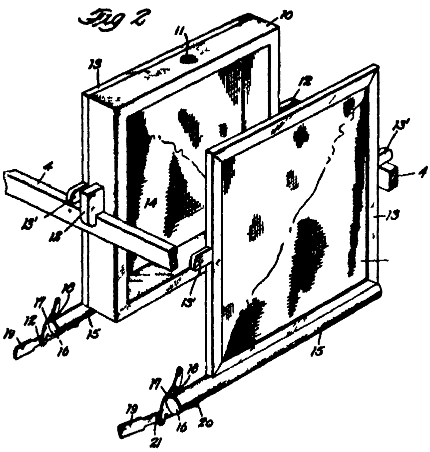
[2] This is the principle of azeotropic mixtures. See *I.S.J.*, 1925, 56; 1926, 385; 1928, 330.

Review of Recent Patents.[1]

UNITED STATES.

FILTER-PLATE. John P. Foster, of Paia, Maui, T.H. 1,722,497. July 30th, 1929.

Each of the filter-plates or filtering elements *per se* is constructed and arranged to be engaged and clamped between two of the filter frames 10 in the usual manner. Ordinarily, these filter plates are made of cast-iron having ribbed or corrugated lateral faces to support the filtering fabric and, in order to impart sufficient strength to these plates, it is necessary to make them of relatively heavy castings, which are generally of the same approximate thickness as the intervening frames. This excessive thickness of the supporting members of the filter-plate is necessary in order to provide sufficient space to form a cored channel in the metal to provide a discharge for the liquids, as well as means for attachment of a faucet to the lower edge of each filter-plate. Each of the filter-plates or elements comprise an open frame 13, the several sides of which are formed of channel sections of relatively thin material, the inwardly opening channels receiving and clamping between the flanged members thereof a supporting screen 14, which may be of wire mesh, which completely fills the space within the frame 13 and is held against displacements by the clamping action of the channel flanges.



If desired, the screen may be covered on each side with a filtering fabric, but ordinarily the fabric, in the form of cloth, paper or the like, is interposed between the abutting faces of each filter-plate and the adjacent filter frames 10, as will be understood. The lower channel section of each plate is provided with an enlarged tubular extension 15, which projects beyond the normal marginal edge of the frame and, therefore, does not interfere with the effective engagement of the lateral faces of the filter-frames 10 and the plate frames 13, said tubular extension running longitudinally of the bottom of the channel section and preferably projecting beyond one lateral edge of the frame 13 to constitute a support for a valve to control the discharge of the filtered liquid collecting in the tubular extension 15. The side channel members of the frame 13 are provided with supporting lugs 13′, 13′, which may be formed either integrally with the channel sections or secured thereto by any suitable means, such as spot welding, said lugs constituting the supports for the individual filter plates on the rails 4.

As illustrated in the drawings, a convenient type of valve or faucet for controlling the discharge of the liquid collecting in the tubular extension or conduit 15 comprises a flap valve 16, adapted to engage the open end of the tubular extensions 15, said flap valve being secured to a curved lever 17, which is pivoted on a lug 18 welded to the tubular extension 15, the said lever being actuated to open and close the valve by handle 19 pivoted to a lug 20, welded to the under side of the extension 15, said handle 19 carrying a roller 21 on one face, which roller engages the curved edge of the lever 17 and swings the latter on its pivotal connexion to effect both the opening and closing movements of the flap valve 16. When the requisite number of plates and frames are assembled, the length of the filter-press, as a whole, will be materially reduced, because of the reduction in the thickness of the individual filter-plates, and,

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

at the same time, decidedly increasing the capacity of the press, as the filtered liquid flows freely into the discharge conduits formed by the tubular enlargements 15, whence it is discharged by opening the valves or faucets.

Extraction of Pure Cellulose from Bagasse. **Earnest C. H. Valet** (assignor to **Celulosa Hemmer Valet, Soc. Anon.**, of Mexico). Reissue, 17,422; original, 1,630,147. September 3rd, 1929.

This invention has for its object to provide a simple and inexpensive process by which the cellulose pulp may be manufactured at the place where sugar cane is grown and crushed, from thence it may be sent in a compressed form to the factories which convert it into paper, cardboard and similar products. The principal difficulty encountered to date in the separation of the pure cellulose from bagasse consists in obtaining a thorough elimination of the sucrose and resinous and other components of the stalks remaining after crushing. A sufficiently complete elimination of all foreign matters is accomplished by the process described hereinafter : Cane, before or after it has passed through the mill, is cut by adequate machinery into lengths of about one inch and carried by conveyors to the macerating tanks wherein takes place the first step of the process. The cane mill may also be connected directly with the macerating tanks which are of a suitable construction and provided with an agitating mechanism, and the macerating liquid may be heated by exhaust steam. The macerating tanks, which as already mentioned may be located at a certain distance from the mills, or adjacent to the same, are filled with a clear solution of lime, which solution may be prepared by adding from about 3 to 5 parts of unslaked lime to 100 parts of water, agitating and permitting the undissolved lime to settle and the bagasse is left to remain in this solution during a variable time which depends upon the system of tanks used and upon the temperature of the solution, which temperature, however, should not reach the boiling point. As soon as the object of this first treatment has been obtained, which is to eliminate certain components of the bagasse which may be an obstacle to its subsequent treatment, the lime solution is drawn off for separate and independent treatment for other products and the bagasse without being washed is carried to cooking tanks especially constructed for obtaining a sufficiently pure cellulose. In case the bagasse has not been cut up into small lengths before being subjected to the treatment with the lime solution, this may be done now before introducing it into the cooking tanks: Claim : A process for extracting the pure cellulose from the bagasse of sugar cane, which consists in macerating the bagasse in a solution of lime contained in a heated tank provided with agitators, in boiling it under pressure in a solution of caustic soda and a solution of sodium salts, in a proportion of about 18 galls. of caustic soda solution and 12 galls. of sodium salts solution to every 100 lbs. of dry bagasse, in separating with a current of fresh steam the dissolved foreign matter from the pure cellulose, and in bleaching the pure cellulose with chlorine, chlorides or electrically. Or a process for extracting the pure cellulose from the bagasse of sugar cane, as set forth above, including the step of adding to the solution of caustic soda and of sodium salts a solution of lime in a proportion of about 12 galls. to every 100 lbs. of dry bagasse.

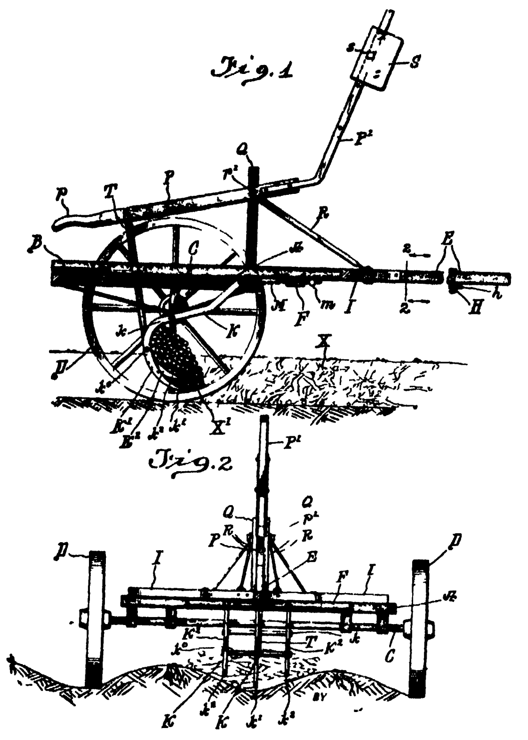
Production, Revivification, and Application of Activated (Decolorizing) Carbons. (*A*) **Johan N. A. Sauer** (assignor to the **N. V. A. Norit Mij.**, of Amsterdam, Holland). 1,709,284. April 16th, 1929. (*B*) **Edouard Urbain**, of Paris. 1,709,503. April 16th, 1929. (*C*) **Julius Drücker and Heinz Thienemann** (assignor to the **I. G. Farbenindustrie, A.-G.**, of Frankfort-on-the-Main, Germany). 1,709,611. April 16th, 1929. (*D*) **Jacque C. Morrell**, of Oak Park, Ill., U.S.A. 1,712,930; 1,713,347. May 14th, 1929.

(*A*) A process of regenerating, purifying, filtering, and decolorizing agents containing absorbed material comprises heating the agent containing the absorbed material to the point of carbonization of an absorbed material and thereafter extracting such product with an alkaline liquid agent capable of removing products of carbonization of said material. (*B*) A method of producing decolorizing carbons

consists in mixing together finely powdered vegetable matter, powdered dicalcium phosphate and sulphuric acid, shaping the mixture and calcining with an elimination of hydrogen, phosphorous and hydrogen phosphides. (*C*) A process for producing active carbon comprises treating carbon at a temperature of about 800-1000°C with sulphur vapours until the carbon has acquired the desired activation, and discharging the residual carbon. (*D*) In a process of activating carbon, treating the carbon with a solution of a halogen in water and neutralizing any halide of hydrogen in the acqueous solution by means of a neutralizing substance which selectively reacts with hydrochloric acid and not with hypochlorous acid.

Apparatus for Drying, Charring and otherwise Treating Loose Material. **Otto Dobbelstein**, of Essen-on-the-Ruhr, Germany. (*A*) 1,718,542. (*B*) 1,748,543. (*C*) 1,718,544. June 25th, 1929. (*A*) An apparatus of the class described, comprises a rotary drum containing inside transverse partitions fixed to the drum and movable therewith so that the drum is thus divided into circumferential chambers alternately designed to be charged with the matter to be heated and to be traversed by a heating medium, means to circulate a heating medium through said chambers for the heating medium, said chambers for the matter to be heated being adapted to receive and deliver the charge at different parts of the circumference of the apparatus, the chambers for the matter to be heated being open at the circumference of the drum and the chambers for the heating medium open adjacent the axis thereof, and means for supporting the drum so that, during each revolution thereof, the contents of each of the chambers for the matter to be heated will be carried from a relatively high point to a relatively low point. (*B*) An apparatus of the character described comprises a rotary drum divided into annular chambers located one behind the other in the direction of the axis of the drum and alternately open at the outer and inner circumferences, the chambers open at the outer circumference adapted to be charged with the material to be treated and to be discharged at a different point, an axial pipe disposed within the drum and divided longitudinally by a partition forming chambers in said pipe, said chambers having openings for the gases used to treat the material, and a gas supply for one of the chambers formed in the pipe and a discharge for the other chamber. (*C*) An apparatus of the class described, comprising a rotary drum having an axial flue and divided into annular material holding compartments and alternating heating chambers located one behind the other in the direction of the axis of the drum, partitions dividing the axial flue into communicating parallel intake, and outlet passages adapted to be successively traversed by the heating gas, said chambers constituting open continuations of said passages and said compartments being exposed thereto to insure direct and uninterrupted flow of the heating gas to and about said compartments and said intake passage being of less cross-sectional dimension than the outlet passage so as to force distribution of the incoming gas to and about said compartments.—Removal of Material from Centrifugal Machines. **Emil Gminder**, of Reutlingen, Germany. 1,718,688. June 25th, 1929. The combination, with a centrifugal machine, of a rotary scratching member adapted for engagement with the inner face of the material treated within said machine, and means to impart relative movement to said scratching member and drum circumferentially of the latter, and means controlled by the amount of material within the drum for automatically varying the position of said member radially of said drum.—Crust Crusher for Beet Cultivation. **Barent O. Jeppson**, of Corinne, Utah, U.S.A. 1,718,823. June 25th, 1929. An attachment for a cultivator comprising a pair of depending bars each bar having notches in one of its edges at its upper end, means for clamping the upper ends of the bars to a part of the cultivator, said clamping means having projections thereon for engaging some of the notches, the lower ends of the bars having elongated slots therein, a shaft passing through the slots, a wheel carried by the shaft, bearing blocks through which the ends of the shaft pass, an upright rod connected with each block, a bracket on each bar having a hole therein through which the rod passes, a spring on each rod between the bracket and the bearing block and spikes carried by the rim of the wheel, said spikes having threaded shanks passing through holes in the rim and nuts engaging the shanks for detachably

holding the spikes to the rim.—PRODUCTION OF MUCIC ACID. **Arlie W. Schorger**, of Madison, Wis. (assignor to **Wood Conversion Co.**, of St. Paul, Minn., U.S.A.). 1,718,837. June 25th, 1929. In the oxidation of solutions of galactose or galactan with nitric acid, the method is claimed of recovering the nitrogen oxides given off during the oxidation by absorption in galactan or galactose solutions, which comprises heating such solution with nitric acid to destroy their tendency to foam anda bsorbing the oxides of nitrogen in the resulting solutions.—CANE PILING MACHINE. **John M. Caffery**, of Franklin, La., U.S.A. 1,718,852. June 25th, 1929. In a cane piling machine, the combination with a vehicle body provided with a driver's platform, of an axle and wheels supporting said vehicle body, a rake pivoted beneath said vehicle body, said rake having a plurality of hook shaped teeth, the central tooth being longer than the others, an operating lever pivoted above said platform elements slidable with respect to the other, a clutch connecting the driving wheel and drum, and a spring actuating the slidable element for the normal engagement of the said clutch.



BEET MOLASSES. **Kikunae Ikeda**, of Tokyo, Japan. 1,721,820. July 23rd, 1929. In a process of manufacturing glutamic acid from waste-water from beetroot sugar molasses from which the sugar has been partially or wholly removed, the steps comprise adding sulphuric acid to precipitate potassium sulphate, removing said potassium sulphate, adding more sulphuric acid to the mother-liquor, heating the mixture thus obtained, removing the greater part of the sulphuric acid in the form of gypsum and crystallizing glutamic acid out of the filtrate from the gypsum.—PURIFYING RAW SUGAR JUICES. **Herman Schreiber**, of Lansing, Mich., U.S.A. 1,724,376. August 13th, 1929. A process of purifying raw sugar juices includes maintaining the raw juices at a moderately elevated temperature but substantially below the boiling point of the juices until no further separation of non-sugars occurs, separating the juices from the non-sugars thrown out of solution or suspension, adding lime to the juices to adjust the hydrogen ion concentration, and heating the limed juices until a clear liquid results.—JUICE THICKENER. **Ernest J. Sweetland** (assignor to **Oliver United Filters, Inc.**, of San Francisco, Cal., U.S.A.). 1,724,436. August 13th, 1929. A filter includes a filter chamber, a filter element in said chamber, an off-take from said element for the conduction of filtrate therethrough, a source of suction, said off-take being disposed at a side of said tank below the normal liquid level thereof, and extending to said source of suction, said off-take being below said liquid level throughout its length.—CRYSTALLIZING APPARATUS. **Bernard H. Varnau and Truman B. Wayne**, of Sugarland, Tex., U.S.A. 1,724,627. August 13th, 1929. A crystallizing apparatus comprising a chamber, a rotatable scatter plate arranged within said chamber, a rotatable centrifugal basket surrounding said scatter plate, means for dis-

charging liquid on to said scatter plate, means for modifying the temperature of the inner wall of said chamber, and means for regulating the extent to which the temperature of said inner wall of said chamber is modified.

UNITED KINGDOM.

CONFECTIONERY. (*A*) **A. W. Frame**, of Eggertsville, New York, U.S.A. 311,916. April 24th, 1928. (*B*) **Magat et Cie, O. Austerwell, and E. Platt**, of Paris. 311,168. September 13th, 1928. (*C*) **E. C. R. Marks** (communicated by **Postum Co., Inc.**, of New York). 311,361. February 10th, 1928.

(*A*) A saccharine mass specially suitable for use in the confectionery, baking and allied industries, is made by heating with agitation a mixture of a sugar such as cane, milk or corn sugar, or saccharine material with water and maltose, raising the temperature with continued stirring and then rapidly cooling. The treatment inhibits or retards the growth of crystals in the mass. The maltose employed is preferably that kind known under the registered trade mark "Spramalt-B."

(*B*) Confectionery giving the sensation of cold in the course of eating is made by preparing a molten mixture of readily digestible fats which is solidified before consumption, the fats being so selected that the solidified mixture has a low melting point and a high latent heat of fusion. Examples of suitable fat mixtures are: 1 part of cocoa-butter with 5 parts of coconut oil or palm-kernel oil, 1 part of refined Illipé butter fat and 5 parts of palm-kernel oil, 2·5 per cent. of cocoa-butter or Illipé butter fat in a mixture of equal parts of coconut and palm-kernel oils. Finely ground sugar or other sweetmeat ingredients are incorporated with the fats and the mass cooled to solidify. De-fatted and roasted cocoa powder may be included in the mixture.

(*C*) The known process of casting chocolate into plates or bars in which moulds on an endless carrier, which are charged with the molten material, are passed through a cooling chamber before the solidified contents are removed, is modified by cooling "relatively rapidly at a substantially uniform rate" to such a point that the material contracts relatively to the metal mould and thus can be removed readily therefrom without breakage. In the preferred method for producing plates of one-eighth of an inch in thickness, a three-stage cooling is adopted. The moulds, charged with material at about 85°F. spend about 4 minutes in traversing a chamber maintained at 55°F., then a further 8 minutes in traversing a second chamber maintained at 45°F during which solidification occurs, and finally spend another 4 minutes in traversing a low temperature chamber during which the relative contraction occurs to permit ready detachment from the walls of the mould.

ALCOHOL AND GLYCERIN. **E. C. R. Marks** (communicated by **Du Pont de Nemours & Co.**, of Wilmington, Delaware, U.S.A.). (*A*) 316,567; (*B*) 316,597, April 27th, 1929. (*A*) In the production of glycerin by yeast fermentation of sugar, the sugar concentration of the alkaline salt solutions added at intervals during fermentation is about that of the mash being fermented. In an example, 6165 grms. of a 30 per cent. solution of blackstrap molasses containing 0·5 per cent. of ammonium sulphate is inoculated with 800 grms. of a culture of an American yeast in a 30 per cent. solution of molasses, and when the fermentation is active 1035 grms. of the blackstrap solution to which has been added 320 grains of soda ash or, as described in Specification 316,597, 374 grms. of crude potassium salts from molasses ash, is added in four equal portions at suitable intervals. Potassium carbonate or other soluble alkaline salts may replace the sodium carbonate. (*B*) Alcohol and glycerin are produced by fermentation with yeast of a solution of sugar to which the incinerated ash of a fermented mash or the soluble potassium salts extracted from said ash are added, preferably in successive doses while the mash is in a state of vigorous fermentation. Thus, a blackstrap molasses mash is subjected to a straight alcohol fermentation, a mixture of potassium salts contained therein is recovered and added to a further molasses mash to promote the formation of glycerin therein, and the potassium salts are again recovered and used. When molasses is replaced by commercial cane and beet sugars, etc., a molasses ash may be used to promote the formation of glycerin. The preferred species of yeast used is that described in detail in Specification 316,567.

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons.	1928. Tons.
Total Receipts, Jan. 1st to October 26th	3,070,535 ..	2,552,724
Deliveries „ „	2,724,607 ..	2,493,452
Meltings by Refiners „ „	2,559,574 ..	2,379,065
Exports of Refined „ „	79,500 ..	84,174
Importers' Stocks, October 26th	444,159 ..	167,812
Total Stocks, October 26th	673,916 ..	272,210
	1928.	1927.
Total Consumption for twelve months	5,542,636 ..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT SEPTEMBER 30TH.

(Tons of 2,240 lbs.)	1927. Tons.	1928. Tons.	1929. Tons.
Exports	3,299,983 ..	2,865,054 ..	4,058,373
Stocks	671,953 ..	629,502 ..	503,592
	3,971,936	3,494,556 ..	4,561,965
Local Consumption..	111,000 ..	58,918 ..	86,678
Receipts at Ports to September 30th ..	4,082,936 ..	3,553,474 ..	4,648,643

Habana, September 30th, 1929.

J. GUMA.—L. MEJER.

Sugar Crops of the World.

(Willett & Gray's Estimates to October 31st, 1929.)

	1928-29. Tons.	1927-28. Tons.	1926-27. Tons.
CANE.			
America	9,148,688	8,147,901	8,607,027
Asia	7,301,498	6,891,715	6,353,682
Australasia	640,034	588,163	484,682
Africa	721,285	656,360	600,997
Europe	——	9,000	6,719
Total Cane	17,811,505	16,293,139	16,053,107
BEET.			
Europe	8,369,526	8,031,874	6,871,892
U.S.A.	938,640	965,241	801,246
Canada.............	28,857	27,212	31,422
Total Beet	9,337,023	9,024,327	7,704,560
TOTAL CANE AND BEET....	27,148,528	25,317,466	23,757,667

United Kingdom Monthly Sugar Report.

Our last report was dated October 10th, 1929.

Sentiment has once more changed and instead of a feeling of firmness which prevailed last month, the producer has shown more eagerness to sell and prices have re-acted accordingly.

The single selling agency in Cuba, which at one time proved to be such a firm holder, has not been making progress with the sale of their sugars as one might have expected, and although they have held off from the market altogether during the Stock Exchange debacle in New York, they will most likely have to lower their ideas considerably before they can effect sales in any large form.

Although the London Raw Terminal Market has been falling, a good business has been doing at all stages of the decline. December has sold down from 8s. 11¼d. to 7s. 9¾d., March from 9s. 3d. to 8s. 3d., May from 9s. 9d. to 8s. 9d., August from 10s. to 9s. 2¼d., whilst December, 1930, sold from 10s. 1½d. to 9s. 4½d.

In the White section business has been strictly limited. December sold from 11s. 6d. down to 10s. 9d., March from 12s. to 11s. 1½d., May from 12s. 3d. to 11s. 7½d. and August from 12s. 7½d. to 12s. The latest prices are :—

	DECEMBER	MARCH	MAY	AUGUST
Raw	7s. 9¾d.	8s. 3d.	8s. 9d.	9s. 2¼d.
White	10s. 7½d.	11s. 1½d.	11s. 6d.	11s. 10½d.

The trade has only bought spasmodically and at declining prices. The Refiners reduced their prices by 3d. on October 21st, 3d. on October 23rd and 3d. on October 28th, and 3d. on November 8th, the latest prices being, No. 1 Cubes 26s. 6d., London Granulated 23s. 1½d. The prices of Home Grown to-day are from 21s. 6d. to 22s. according to factory.

Raw Sugars have not been plentiful and our Refiners have bought any small parcels that have been afloat or near at hand, from 9s. down to 8s. 6d. c.i.f.

The chief feature this month is the sale by the Cuban Syndicate of 50,000 tons to the English Refiners at 9s. 4½d. c.i.f.

With regard to Europe, F. O. Licht issued a supplementary estimate at the end of October, increasing his September estimate by 20,000 tons, his figure now being 8,174,000 tons, against last year's 8,467,000 tons.

21, Mincing Lane,
London, E.C.3.
11th November, 1929.

Arthur B. Hodge.
Sugar Merchants and Brokers.

THE
INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 372. DECEMBER, 1929 VOL. XXXI.

Notes and Comments.

The Outlook.

Just after we closed for press last month there came the news that after all Java had finally decided not to give support to the idea of crop control such as the Brussels conference was working for. It had all along been known that the co-operation of Java was somewhat doubtful; but as the United Java Sugar Producers—the V.S P —had promised a careful examination of the proposals it was rather widely expected that a final agreement would be reached. However, the V.S.P. has stated as its reason for refusing that the statistical position of the world has improved sufficiently to render the Brussels negotiations fruitless. The question now remains whether the other members of the Conference will carry on their investigations without Java. LICHT states that the matter has been discussed already during the Brussels negotiations and that Cuba is reported to have ratified in the meantime the Brussels agreements. If, in addition to the countries represented at Brussels, Peru, Haiti and San Domingo decide to join in some concerted measures, the conference may yet achieve some tangible results.

Meantime the market remains much as it was; few big deals are reported because the Cuban Single Seller continues to hold off and has refused all bids below 1·85 cents, at which price a lot of 40,000 tons has been sold to Europe, equivalent to 9s. 4½d. c.i.f. WILLETT & GRAY have made a rough calculation of the total quantity of sugar declined in bids since the Single Seller started operations, and find it amounts to about 1¼ million tons. This figure of course includes a duplication of bids made on different days, but nevertheless gives some idea of the heavy amount of business declined by Cuba. Since it is thought that Cuba will not start the 1930 crop before January 15th, the new sugars will not come on the market just yet. As for Java, she has had to be content with a crop this year of 2,942,000 tons, instead of the earlier estimate of 3½ millions or more. Her carry-over promises to be some 33,000 tons more than last year, but as at May 1st last year the balance of old-crop sugar was under 10,000 tons, it is not likely that the balance next May will be appreciably greater, in view of the increased demand from the East for Java sugars. As shown on another page, Java sugars are acquiring increased popularity in China at the expense of Japanese imports, and with the country less unsettled the demand for sugar should tend to increase.

LICHT has put up his figures for the European Beet Crop "without Russia" by 150,000 tons since last month. On this basis Europe without Russia actually shows an increase, as against 1928-29, of 0·25 per cent. Including Russia, there remains a decrease of 2·70 per cent. Germany accounts for 100,000 tons of the improvement, and Poland for 30,000 tons.

At home the uncertainty of the impending 1930 Labour Budget intrudes its shadow on all sugar transactions, because there is no security against a change in the incidence of the sugar duties as regards home and foreign refined, nor as respects Imperial preference rates. Mr. SNOWDEN's free trade predilections are well known ; but the grave problem of unemployment which threatens to create a crisis in political circles this winter will not render it any easier to forego useful revenue. It is of course not impossible that new taxation may be attempted of a degree that might allow the Government to take off taxes here or there, but this is not a policy lightly to be entered on by a Government that has not an actual majority in its favour, and must endeavour to keep the two sections of the Opposition from combining.

Willett & Gray's 1929-30 Cane Crop Forecast.

As usual with November, Messrs. WILLETT & GRAY, the New York sugar statisticians, make their first attempt at forecasting the new year sugar crop, and their figures for 1929-30 have been awaited with more than ordinary interest. These preliminary estimates are at best, as the firm themselves point out, only an indication ; but in past years they have as a rule approximated fairly closely to the actual result achieved. This year for the first time since 1926-27 there is to be a break in the tale of steady expansion, which is all the more welcome since that of 1926-27 was the only other break in a period now reaching to 10 years ; the other eight crops all showed more or less appreciable increases, of which 1924-25 was easily the biggest with over 3½ million tons expansion. It is admittedly too early to say whether the decrease now indicated for 1929-30 as compared with 1928-29 will actually pan out ; Messrs. WILLETT & GRAY put it at the figure of 381,732 tons, the decrease for cane amounting to nearly 220,000 and that for beet to 162,000 tons, but LICHT, as above shown, has already wiped out nearly half the beet sugar deficit. Whether this decrease is actually established or not, it is clear that the expansion of 1928-29 over 1927-28 (1,850,766 tons) is not to be repeated, and hence the ascendancy of production over consumption is in sight of elimination for the time being ; this will be particularly the case if consumption during 1930 achieves its annual average increase of some 3 to 4 per cent.

To turn to the individual crops, Cuba is put at 250,000 tons less, or at 4,900,000 tons, which figure is yet some 200,000 tons higher than our Cuban correspondent estimated a month or two ago. Hawaii, the Philippines, Argentina, Java and Australia all show slight decreases. On the other hand, Porto Rico breaks new records with an increase of 150,000 tons to 680,000, while Louisiana, with her new POJ plantings, accounts for some 75,000 tons more. Natal is stationary, Formosa, Mauritius, Australia, and the British West Indies each a few thousand tons less. The American beet crop is put at some 60,000 tons more, but the European one at 226,000 tons less. Great Britain and Ireland are given an increase (in refined) of 56,000 tons. CZARNIKOW points out the interesting fact that the estimated total production of those countries enjoying freedom of duty in the United States, together with U.S. Domestic cane and beet, shows an increase over last season's output of 270,000 tons. This may or may not be an outcome of

Cuba's policy of crop restriction of late years, but it is certainly some indication of the further scope for expansion inherent in the U.S. domestic production. In the case of the other countries mentioned and some others, it is clear that the persistently uneconomic price sugar has been fetching has had its effect in banishing all thought of expansion ; so existing acreages are being adhered to till prices are more remunerative.

Fibre Boarding Manufacture from Bagasse.

One of the solutions indicated for the unsatisfactory state of affairs that prevails in the sugar industry is the adoption of methods that will result in the principal by-products, viz., bagasse and molasses, yielding a much better price to the mill owner than has hitherto been the case. Experiments with the use of bagasse as raw material for paper making are not new, but for a number of reasons, economic and otherwise, the idea has not caught on. More success is being met with in the application of bagasse to the manufacture of fibre boarding and at least one company has been successfully engaged for some time past both in America and in Australia in buying bagasse from the adjacent sugar factories and converting it into boarding. The drawback of the latter scheme from the point of view of the sugar factory owner is that he receives for his by-product a price that may bear little relation to the prices obtainable for the finished boarding. What he wants is a scheme under which the sugar factory itself can turn its own bagasse into boarding and sell this on the market at a price that, to judge from current quotations for fibre boarding, will add as much as 100 per cent. to the profits of the factory, as compared with selling the sugar alone and using the bagasse as fuel or otherwise disposing of it. Such a scheme is in fact outlined on another page of this issue, where our Cuban Correspondent describes the process devised by Mr. E. A. VAZQUEZ of Havana, known as the Vazcane Process, which is being tested in a small factory near Havana, and, on a small scale at any rate, gives promise of being a more or less practicable proposition. Not the least valuable part of the paper is that section which deals with the £. s. d. of this or any analogous scheme from the point of view of the sugar factory owner. Mr. SYMES shows that after allowing for the cost of coal or oil fuel that is needed to replace the bagasse otherwise employed, the value of the bagasse on a wet fuel basis is increased from two or three dollars to between twenty and thirty dollars per ton, and indeed when turned into boarding will, at current prices, fetch for the factory more per ton of boarding than does the sugar per ton. It is obvious, then, that any such scheme which proves practicable will open up a vista of profits for the sugar factory owner such as would go a long way to solve the present unprofitable status of the sugar industry. Can it be done ?

The Vazcane Process.

But when we come to examine the details of the Vazcane Process we find a number of problems that seem likely to prove difficult of solution. The following are a few points as to which further enlightenment might be useful. In the first place, the claim that the process eliminates all cane mills and crushers, defecators, scum tanks, filter-presses, etc., appears on the face of it too sweeping. In place of them the process would employ a single carborundum stone roller of the type used in wood pulp factories and a series of shallow solvent baths from which, finally, the separated juice is sent direct to the evaporators. One would have thought that the finer comminution of the cane would have resulted in more gummy matter entering the juice and that something more than filtration through bagasse was needed to eliminate it, at any

rate for the higher grades of sugar. But the main difficulty that presents itself to the student of the process is the substitute proposed for the milling train. The experimental factory near Havana has a capacity of but 50 tons of cane per day, or 2 tons cane per hour, and the horse-power employed per T.C.H. works out at 50. Any large Cuban central with a capacity of 150 to 200 T.C.H. would require at the above rate something like 7500 H.P., which compares with a milling train of seven units of the largest size requiring 2500 H.P. only. And when we come to consider the grinding stone proposed it would appear to have a capacity of but 10 tons cane per hour ; in that event a large central would require some 20 to 25 grinding stones and if it be the case that each of them requires its own set of solvent baths, then the cost of the outfit and the floor space required would seem to mount to excessive proportions. Finally, we would ask how it is proposed to roughen or " burr " the carborundum rolls ? If the feat is at all possible, let alone in 30 minutes, it can only be by means of a diamond cutter, the cost of which would seem prohibitive.

We repeat that we think there is much in the idea of a sugar-cum-fibre factory that will appeal to the present-day mill owner faced by low profits, and all experimentation with this broad object in view is to be welcomed. But we question whether the drastic sweeping aside of a large part of existing sugar factory lay-out is a proposition that will appeal to the bulk of existing factory owners. The change may justify itself in the end, but at the present stage of evolution, as we understand it, we think the average factory owner will prefer a scheme under which he can simply tack on to his existing plant a fibre board manufacturing unit. What is more, we wonder whether the true solution of the problem does not rather lie in the adoption of some form or other of milling-diffusion, in which the pulp from the diffusers would equally well serve for the raw material for the boarding. But Mr. VAZQUEZ has apparently been the first to come forward with a scheme that offers inducements to the mill owner to employ his surplus bagasse to the best advantage, and further details as to its capabilities when applied to large capacity manufacture will undoubtedly be welcomed.

William Connal & Co., of Glasgow.

What was undoubtedly the oldest firm of sugar brokers in Great Britain, Messrs. WILLIAM CONNAL & COMPANY of Glasgow, has lately ceased operations after a career that under one name or another and in various trades can be traced back to the time of GEORGE I. Down to last September the partnership latterly consisted of Mr. WILLIAM WILSON and Mr. A. F. C. M'SPORRAN, but with the latter's death Mr. WILSON decided to retire in view of the fact that sugar broking conditions on the Clyde have changed vastly since the decline of the Greenock refining trade and its more recent acquisition by the big refining firm of TATE & LYLE. So, much to our regret, a firm that was of world-wide reputation and well known through its succinct annual reports of the sugar trade in the United Kingdom—reports that we were invariably glad to reproduce in part—ceases to exist save in the history of the Clyde sugar industry.

As stated above, the firm can trace back its connexion with trade from the days of GEORGE I. This connexion dates, in fact, from 1722 when the first firm were Virginia traders. A sequence of six other firms followed, all connected with overseas trade in Glasgow, and finally in 1826 was founded the original firm of WILLIAM CONNAL which dealt largely in sugar and tea. WILLIAM CONNAL himself was one of the original partners of what is now the

Cunard Steamship Company, and also of the Clyde Shipping Co. He died in 1856 and his nephew, MICHAEL CONNAL, carried on the sugar and tea business under the later style of W. Connal & Co. In 1862 he was joined in partnership by Mr. WILLIAM WILSON who remains the sole survivor of the succession of partners, and the one with whom the present generation has had pleasant associations. MICHAEL CONNAL was a strenuous worker, and besides carrying on his own business at Virginia Buildings, he undertook an extraordinary amount of public work, educational, social, charitable, religious. He was knighted by QUEEN VICTORIA, and died in 1893 at the age of 76. Since then other partners have joined Mr. WILSON, but with their deaths, he has decided to retire and thus ends, undoubtedly regretted by all, what the *Glasgow Herald* in some interesting reminiscences (from which we have quoted) describes as "the Auld Hoose of William Connal & Co."

Leeward Islands Sugar Company Reports.

ANTIGUA SUGAR FACTORY LTD.—The tenth annual report of this Company, for the year ending September last, shows that the past season was much less successful than that of 1927-29,[1] owing to the cane crops suffering severely from drought during the first half of 1928. As a consequence the sugar output amounted to only 9104 tons (as against 17,088 tons in 1928 and 19,794 tons in 1927) or 47 per cent. below that of 1928. The results of the year were further seriously affected by a heavy fall in sugar prices; the average sale price was £11. 9s. 0d. f.o.b., or about 22 per cent. below that of 1928 when £13. 10s. 0d. was obtained, but it was higher than the 1927 figure and not greatly less than the price obtained in the previous four years (1923-1926). The extraordinary high yield of 1928 (13·10) was not repeated, the figure being 11·12 or about the average of the five years to 1927, as was also the juice purity at 82·90. As a consequence of this bad crop the profit and loss account shows a deficit of £6945, and after deducting this from the carry forward of the previous year, there remains a net balance of £23,871, out of which a dividend of 5 per cent. is being paid, and the balance of £14,696 carried forward.

ST. KITTS (BASSE TERRE) SUGAR FACTORY LTD.—The annual report for the year ending September 30th last shows that after a run of five years of steadily increasing sugar outputs, the Company has had this year to face a sharp decline, the quantity only reaching 13,724 tons of sugar or 30 per cent. less than last year when 19,443 tons was obtained. This was due to severe drought during the first half of 1928, and to the hurricane in September, 1928. The results of the year were (as in Antigua) seriously affected by the heavy drop in sugar prices, as a consequence of which the average sale price, f.o.b., was only £11. 16s. 4d. which compares with £14. 18s. 0d. in 1928 and £16. 14s. 7d. in 1927. The purity of juice was 83·66 as compared with 84·36 in 1928; the yield of sugar was 11·40 as compared with 11·86, but the recovery of sucrose in cane, at 88·04, was the highest attained. After charging revenue with interest on debentures, there remains a surplus of £17,966 which is allotted, as to "B" shareholders £162 (being 5 per cent. interest), as to the original contractors (planters) £8,821, and the balance of £8983 to the "A" shareholders, the London holding company. The latter with the amount brought forward from 1928 have £44,462 to dispose of, and are paying a dividend of 10 per cent. absorbing £11,700, and carrying forward £32,762.

1 See *I.S.J.*, 1928, 631.

The Incidence of Sugar Duties on World Retail Prices.

Dr. H. C. Prinsen Geerligs recently published three articles in the Amsterdam *Telegraaf*, containing some completely new material on the sugar question which has since been circulated to members of the Economic Committee of the League of Nations. He obtained, for a considerable number of countries, the retail prices of sugar existing in the second half of June, 1929, and on the basis of these figures, and of the rates of import and excise duties collected for the Economic Committee by Dr. Mikusch, it was possible to make an estimate of the amounts paid by consumers in excess of world market prices. Below we give the principal tables prepared by Dr. Geerligs together with such of his comments as seem necessary for their understanding.

No figures being available for certain countries, the estimates cover only the consumption of some 15 million tons of refined, i.e., over two-thirds of the total world consumption. The retail figures are not wholly comparable, since the quality of sugar is not the same everywhere; but where possible the price given is that of first grade refined sugar in loose crystals. In some places, however, retailers sell white sugar not merely without profit but even at a loss, recouping themselves by the more profitable prices they charge for tea, coffee, etc.

At the time of investigation the wholesale price of first grade refined sugar in loose crystals at Amsterdam, free of excise, at warehouse, was 13·25 fl. per 100 kg., and this was taken as the basic figure. Allowing for incidental expenses between the warehouse and the retailer, a net retail price of 0·21 fl. is taken as the minimum at which the producer can supply the article at the purchaser's door.

Table I.—Comparative Table of Retail and Net Prices of Refined Sugar in Various Countries.

	Price per kg.	Rate of Exchange. Florins.	Converted into florins per kg.	Consumption Tax. Amount.	Consumption Tax. Converted into florins per kg.	Net price in florins per kg.
Italy	6·75 lire	13·00	0·88	400 l	0·52½	0·35½
Spain	1·90 pes.	35·20	0·66½	45 p.	0·16	0·50½
Australia	4½d.[1]	12·06	0·50	—	—	0·50
Japan	0·25 yen.	124	0·50	8·35 y.	0·16	0·34
Hungary	1·15 pengö	43·5	0·49½	40·6 p.	0·17½	0·32
Rumania	33·5 lei	1·48	0·49	400 lei.	0·06	0·43
Netherlands	48 ct.	—	0·48	27 ct.	0·27	0·21
Czecho-slovakia	6 Cr.	7·40	0·44½	184 cr.	0·14	0·30½
Poland	1·46 zloty	28	0·41	38·52 zl.	0·11	0·30
France	4·20 frcs.	9·75	0·41	125 frs.[5]	0·12	0·29
Germany	64 pf.	59·35	0·38	10·5 M.	0·06	0·32
Argentina	0·345 peso	104	0·35	—	—	0·35
Great Britain	2¾d.[1]	12·06	0·32	5s. 10d.	0·06½	0·25½
Austria	0·88 sch.	35	0·31	16 cr. g.	0·08	0·23
Sweden	45 öre	66·7	0·30	4 öre	0·03	0·27
U.S.A.	5½ c.[1]	2·50	0·29	—	—	0·29
Switzerland	55 c.	48	0·26½	—	—	0·26½
British India	4 to 8 p.[2, 3]	91	0·26	—	—	0·26
Denmark	38 öre	66·3	0·25	5·7 öre	0·04	0·21
Belgium	2·20 frcs.[3]	34·60	0·15	40 frcs.[6]	0·03	0·12
Belgium	4·20[4]	34·60	0·29	—	0·03	0·26

[1] Per lb. (453 grms.) [2] Per seer (933 grms.). [3] Granulated sugar. [4] Refined lump sugar.
[5] Since August 1st reduced to 100 francs and since November 19th to 85 francs.
[6] Is to be reduced to 20 francs.

Next comes a comparative table (Table II), stating the import duties on sugar and the total duties in the various countries. In considering the total

duties, we must remember that these are not levied on all sugar consumed, since in the first place all home-produced sugar is excluded, and in the second place sugar is imported into the chief importing countries in its raw state, and the duty payable is usually much lower.

Of these countries, Great Britain, the United States, British India and Canada alone import large quantities of sugar (on which duty is payable) the total amount being about 6½ million tons, while the aggregate total imported by Austria, France, Switzerland, Sweden, Denmark and a number of other countries is about 500,000 tons. Thus, not more than a quarter of the total world output is subject to import duty.

Then again, sugar may be imported not in a refined condition but raw, and the big importing countries obtain it in this state as far as possible from countries to which preferential duties are granted. Consequently the import duty into the United States amounts in practice to 1·76 cents per lb., or 0·10 fl. per kg. and the British import duty to from 4s. 4·8d. to 8s. 1·6d. per cwt., or 0·05 to 0·10 fl per kg.

The average figure for the whole world actually charged as import duty is about 0·08 fl. per kg. The amount collected on 7 million tons is thus no more than 560 million fl.,—not a very large sum for an article of which 25 million tons are handled every year. Thus, the part played by import duties is by no means represented by the sums they bring in to the treasury; they are intended primarily to form tariff walls, behind which the industry can shelter itself and raise the home price above world parity. By this means the industries can continue to exist even when the world price falls below their cost price.

TABLE II.—IMPORT DUTY.[a]

	Amount.	Converted into florins per kg.	Total Import and Consumption Duties, florins per kg.
Italy	36 lire (gold)[c]	0·17	0·69½
Spain	60 pes. (gold)	0·29	0·45
Australia	£14 per ton	0·17	0·17
Japan	7·4 yen per picul	0·14	0·30
Hungary	26 crs. (gold)	0·13	0·40½
Rumania	2000 lei	0·30	0·36
Netherlands	——	—	0·27
Czecho-slovakia	338 crs. (paper)[c]	0·25	0·39
Poland	60 zloty	0·16½	0·27½
France	100 francs[b]	0·10	0·22
Germany	25 marks	0·15	0·21
Argentina	0·096 pes. (gold)	0·23	0·23
Great Britain	11s. 8d. or 5s. 10d. per cwt.	0·07 0·14	0·13 0·20
Austria	18 crowns (gold)	0·09	0·17
Sweden	10 öre	0·07	0·10
U.S.A.	2·344 cents per lb.	0·13	0·13
Switzerland	10 francs	0·05	0·05
British India	4 r. 8 a. per cwt.	0·08½	0·08½
Denmark	4·3 öre[c]	0·03	0·04
Belgium	80 francs	0·05½	0·05½

a Where no weight is stated, the unit is 100 kg.
b Has been increased by 40 francs on 19th November. *c* Inclusive of consumption tax.

Table III shows the net price (i.e. less excise), the protective import duties in 1927 and 1928, the price less all duties, and lastly, the *per capita* consumption of sugar in kilograms reduced to terms of raw sugar, and the

total in thousands of tons of raw sugar. All the figures are again taken from the memorandum of the League of Nations.

TABLE III.

	Net Price florins per kg.	Protective Duty florins per kg.	Difference florins per kg.	Per Capita Consumption in kg. (raw)	Total consumption in thousands of tons (raw)
Italy	0·35½	0·17	0·18½	9·1	379
Spain	0·50½	0·29	0·21	12·2	268
Australia	0·50	0·17	0·33	58·0	362
Japan	0·34	0·14	0·20	10·3	885
Hungary	0·32	0·13	0·19	13·5	113
Rumania	0·43	0·30	0·13	?	?
Netherlands	0·21	—	0·21	30·6	233
Czecho-slokavia	0·30½	0·11	0·19	27·0	393
Poland	0·30	0·16½	0·13½	12·7	386
France	0·29	0·10	0·19	23·8	971
Germany	0·32	0·15	0·17	25·4	1626
Argentina	0·35	0·23	0·12	31·1	330
Great Britain	0·25½	0·10	0·15½	44·8	2072
Austria	0·23	0·09	0·14	30·0	202
Sweden	0·27	0·07	0·20	37·7	230
U.S.A.	0·29	0·10	0·19	49·6	5889
Switzerland	0·26½	0·05	0·21½	42·5	166
British India	0·26	0·08½	0·17½	?	?
Denmark	0·21½	—	0·21½	51·7	183
Belgium	0·12	0·03	0·09	26·4	210

From the last two Tables it will be seen that although the import duty undoubtedly helps to raise the price of sugar in protectionist countries above world parity, and so to provide producers in those countries with profits, which have to be paid for by the consumer, the protection afforded is by no means exploited to the full, for if we take the standard figure of 21 cents, which was the price in the Netherlands and Denmark last June, any lower price must be regarded as due to the fact that the import duty is not being utilized to the full.

Statistics do not indicate any clear connexion between sugar duties and consumption but, generally speaking, show that a heavy duty goes together with a small consumption.

It may now be stated how much the consumer pays as a result of the duties levied. Taking first consumption taxes, it is reckoned that a revenue of 867 million florins is received by the various countries on this score. Then as regards import duties Dr. GEERLIGS calculates how much sugar costs, after deduction of the consumption duty, over and above the minimum price of 21 cents, and has taken this amount as representing the actual protection afforded. For the various countries the amount paid in excess of the minimum amounts to a total of 1207 million florins.

The following then represents very roughly the figures for the 15 million tons of refined sugar consumed, as set forth in these statistics.

	Million Florins
Price paid to producers (including the retailer) for sugar alone (15 million tons at 210 florins per ton)	3150
Additional amount paid to producers as a consequence of Import Duties	700
Import Duties paid to the Treasuries	500
Consumption Tax paid to the Treasuries	867
Total amount paid	5217

Thus, to every 100 florins paid for sugar at world market prices, 66 florins are added as a result of important excise duties, and of this last sum 43 florins go to the Treasury and 23 to the producer.

The calculation does not take into account the direct or indirect subsidies to the sugar industry, such as exist in Great Britain, Ireland, Czecho-Slovakia, Austria and other countries.

China's Sugar Trade in 1928.

Communicated by Mr. WALTER BUCHLER.

The following is an extract from the Report of the Chinese Maritime Customs :—

" There was a distinct improvement in the market during 1928. Sugar being one of the necessities of life, it was natural that, amid circumstances of greater security, demand should immediately revive throughout China. Thus it was that all the main varieties—brown, white, and refined—were imported in greatly increased quantities, while the main producing centres for the China market were able to record enhanced profits. The greatest advance was made by the Dutch Indies, importations from which source increased by 86 per cent. There is no doubt as to the growing popularity of Java sugar in China and during the year under review the boycott of Japanese sugar during the second part of the year drew attention to the rival merits of the Java product. Java, on the other hand, has of late been paying increased attention to the requirements of the China market in respect of such products as molasses and refined sugar. Japan, which has hitherto been the main producing centre for the latter variety, may therefore have to encounter keen competition in the future. As regards the Japanese trade during 1928, importations from that source show an increase of 34 per cent. Towards the end of January the Shanghai Sugar Guild relinquished control of their stocks of Japanese sugar. The result was considerable activity in refineds during March, business being done on a basis of Taels 7·70 and large sales resulting. In May, however, the anti-Japanese boycott revived, and as has already been seen, Java sugar benefited greatly thereby. Hongkong refineds also gained in popularity, and a demand ensued which could only be met in part. Prices for refineds accordingly rose to the level of Taels 9·45 and by the end of the year stood at Taels 8·80. Despite all boycott activities, a renewed demand for Japanese refineds was evident as the year drew to its close, dealers buying in supplies wherever possible in anticipation of higher tariff charges.

Importations of sugar during 1928, when compared with those of the preceding year, show the following increases : brown from 1,814,030 to 3,032,614 ; white, from 4,493,302 to 6,169,406 piculs ; refined, from 3,324,064 to 4,110,793 piculs. The share taken by the principal countries of origin is shown in the following table :—

	1926. Piculs.	1927. Piculs.	1928. Piculs.
Dutch East Indies	2,935,915	2,780,570	5,171,063
Hongkong	3,270,208	2,793,023	3,525,838
Japan	2,959,556	2,604,200	3,484,070
Korea	176,655	253,215	367,112
Philippine Islands	549,681	379,401	344,046
Russia, Pacific Ports	127,172	304,909	250,986
Macao	40,333	98,607	127,239

NOTE.—1 picul is the equivalent of 133⅓ lbs. Value of 1 Tael in 1928 = 2s. 7½d.

"Lost Juice per Cent. Fibre."

Factor for Judging Milling Work in Java.

By Dr. FRANCIS MAXWELL.

On glancing over the milling reports periodically issued by the Experiment Station of Java (" Molencontrole "), it will be noted that the factories therein comprised are tabulated in the order of their relative figures representing " lost juice per cent. fibre."

This term was officially adopted in 1923 and has since become the primary basis for judging milling results in Java. Its application is so far confined to that country, and from questions frequently put to the writer it would appear that its conception is only vaguely comprehended by some who are engaged in the engineering side of milling in other countries. Hence a few explanatory remarks[1] from this point of view may perhaps be useful.

" Lost juice per cent. fibre " means the amount of juice that remains unrecovered in the bagasse from the last mill[2] on 100 parts of fibre. By this juice is understood that of the last mill but in an undiluted state, thus having a Brix of the primary[3] juice and a Purity of the juice of the last mill.

It is calculated according to the formula :—

(*a*) Lost juice per cent. fibre =

$$100 \times \frac{\text{Brix per cent. bagasse.}}{\text{Brix Primary Juice.}} \times \frac{100}{\text{fibre per cent. bagasse.}}$$

Brix of the bagasse is customarily expressed thus :—

$$(b)\ \text{Brix per cent. bagasse} = \frac{100 \times \text{Pol. bagasse.}}{\text{Purity last mill juice.}}$$

By inserting this value (*b*) into the first equation (*a*) the formula becomes :

(*c*) Lost juice per cent. fibre =

$$\frac{\text{Pol. bagasse.}}{\text{Purity last mill juice.}} \times \frac{10^6}{\text{Brix primary juice} \times \text{fibre per cent. bagasse}}$$

The data required from the laboratory for the calculation of the lost juice per cent. fibre are thus :—

1. Pol. of the bagasse.
2. Pol. and Brix of the last mill juice.
3. Brix of the primary juice.
4. Dry substance of the bagasse.

From the latter figure (4) the fibre per cent. bagasse is derived by subtracting Brix of bagasse (*b*) therefrom, thus :—

Fibre per cent. bagasse =

$$\text{dry substance of bagasse} - \frac{100 \times \text{pol. bagasse.}}{\text{Purity last mill juice.}}$$

As the above calculations may appear somewhat involved to the practical sugar engineer who is not well versed in chemical formulae, the method is best shown by a concrete example completely worked out.

Example.—Laboratory Data.

Final Bagasse. Pol.		Final Bagasse. Dry Substance.		Brix of primary juice.		Purity juice last mill.
1·9	..	60·6	..	18·9	..	74·7

[1] The terms used in this article are those recently adopted by the Committee of the International Society of Sugar Cane Technologists on " Uniformity in Reporting Factory Data."
[2] Henceforth briefly referred to as " bagasse."
[3] Primary juice (Voorperssap) = juice expressed before dilution.

MILLING WORK IN JAVA.—Data relating to some Outstanding Results.

No. of Factories.	Best Factory	Lost Juice per cent. Fibre.	Extraction	Capacity Tons/Day.	Imbibition per cent. Fibre.	Cane Pol.	Cane Fibre.	Bagasse Pol.	Bagasse Moisture.	Size of Installation.
					3 MILLS.					
10	Phaiton	40	93·7	588	154	13·8	13·7	3·4	42·2	Mills 30 in. × 60 in.
					CRUSHER AND 3 MILLS.					
6	Sedatie	41	94·2	697	137	13·9	12·5	3·3	44·9	Cr. 26 in. × 60 in., Mills 30 in. × 60 in.
					CRUSHER, SEARBY SHREDDER AND 3 MILLS WITH HOT MACERATION CARRIER. (SYSTEM NOBEL).					
1	Modjoagoeng	35	93·9	1196	132	13·7	15·1	2·9	43·6	One Maceration Carrier between 2nd and 3rd Mills. Cr. 26 in. × 60 in., Mills 30 in. × 60 in. Searby 40 in. × 56 in.
					4 MILLS.					
25	Petaroekan	29	95·7	1245	150	14·9	14·2	2·5	41·4	Mills 34 in. × 78 in.
					4 MILLS WITH HOT MACERATION. CARRIERS (SYSTEM NOBEL).					
1	Kedawoeng	22	96·6	547	214	13·5	13·7	1·8	45·7	Maceration Carrier between 2nd and 3rd Mills and Maceration Carrier between 3rd and 4th Mills. Mills 30 in. × 60 in.
					CRUSHER AND 4 MILLS. (IN SOME CASES A SEARBY OR DISC SHREDDER TAKES THE PLACE OF THE CRUSHER).					
91	Poppoh*	23	96·9	1228	149	13·2	12·9	1·9	39·4	Cr. 30 in. × 60 in. Mills 32 in. × 72 in.
					CRUSHER AND 4 MILLS WITH HOT MACERATION CARRIERS. (SYSTEM NOBEL).					
3	Djombang	16	98·1	948	153	13·1	12·1	1·2	38·3	Maceration Carrier between 2nd and 3rd Mills and Maceration Carrier between 3rd and 4th Mills. Cr. 26 in. × 60 in., 3 Mills 30 in. × 66 in., 1 Mill 31½ in. × 66 in.
					5 MILLS.					
7 {	Kartasoëra	27	96·6	1152	143	14·1	12·4	2·1	43·9	2 Mills 32 in. × 72 in., 3 Mills 30 in. × 60 in.
	Beran	27	96·6	1229	141	14·8	11·9	2·2	44·6	1 Mill 32 in. × 72 in., 4 Mills 30 in. × 60 in.
					CRUSHER AND 5 MILLS.					
18 {	Sempalwadak	24	97·1	1396	135	16·0	11·8	2·1	44·3	Cr. 28 in. × 60 in., Mills 30 in. × 60 in.
	Seloredjo	24	95·9	1323	121	13·7	15·0	2·1	42·3	Cr. 30 in. × 60 in., Mills 30 in. × 60 in.
	Poerwoasrie	24	96·6	1798	141	13·6	13·1	1·7	48·2	Cr. 34 in. × 78 in., 3 Mills 34 in. × 78 in., 2 Mills 32 in. × 72 in.
					6 MILLS.					
1	Koedjonmanis	38	93·0	1224	147	13·0	15·9	2·7	46·5	3 Mills 30 in. × 60 in., 1 Mill 32 in. × 70 in., 2 Mills 30 in. × 60 in.
					CRUSHER AND 6 MILLS.					
1	Tasikmadoe	31	95·7	2277	119	14·6	13·3	2·5	44·1	Cr. 36 in. × 84 in., Mills 36 in. × 84 in.

* Maxwell Shredder fitted to Crusher.

Brix of final bagasse =

$$\frac{100 \times \text{Polarization of final bagasse.}}{\text{Purity of last mill juice.}} = \frac{100 \times 1{\cdot}9}{74{\cdot}7} = 2{\cdot}54.$$

Lost juice per cent. fibre =

$$\frac{\text{Pol. final bagasse.}}{\text{Purity last mill juice.}} \times \frac{10^6}{\text{Brix of first expressed juice} \times \text{fibre per cent. final bagasse.}} =$$

$$\frac{1{\cdot}9}{74{\cdot}7} \times \frac{1{,}000{,}000}{18{\cdot}9 \times (60{\cdot}6 - 2{\cdot}54)} = 23{\cdot}17, \text{ say } 23.$$

The important fact will be noted that by calculating the lost juice in the bagasse on the basis of 100 parts of fibre, differences in the fibre content of cane are thereby eliminated and a comparison of milling work by this method is accordingly rendered more rational.

When comparing the efficiency of milling plants, as is so frequently done, on the basis of "extraction," it is plain that this figure is greatly influenced by the fibre factor : a more fibrous cane contains less juice, and in addition, it implies a larger amount of bagasse which retains a correspondingly greater amount of juice. Hence comparisons in extraction, without taking into account the fibre factor, are inaccurate and misleading.

It is, of course, not claimed that the "lost juice per cent. fibre" affords a perfect criterion, since it does not entirely obviate the influences inherent in the kind of cane and other factors that are unknown and can, therefore, not be brought into calculation. For practical purposes, however, it is considered that the "lost juice per cent. fibre" figure forms the fairest basis hitherto evolved.

It must nevertheless be borne in mind that this figure by itself affords only a broad basis for judging technically the efficiency of different milling plants. For the comparison of their economic efficiency it is evident that a number of other data besides the "lost juice per cent. fibre" are to be taken into account, such as those relating to capacity, maceration, extraction, composition of milling trains, sizes of units, etc.

The annual issues of the "Molencontrole" compiled by the Proefstation furnish complete tables of such data. The factories therein are first segregated into groups according to the numerical composition of their milling trains and are then arranged in the order of their "lost juice per cent. fibre" figures, highest at the top and lowest at the bottom of the list. This method of tabulation incidentally engenders a friendly rivalry among the factories, each endeavouring to reach the bottom of the column by producing the lowest figure for "lost juice per cent. fibre." Fortnightly reports are distributed among the factories subscribing to the Proefstation, in which reports, similar to the annual one, a summary is included stating the factories that have obtained the best results in their respective groups.

In conclusion, it may be of general interest to append a Table giving the most important data relating to the best results appearing in the latest fortnightly issue of the "Molencontrole" (1-16th August, 1929) that has come to hand.

The Vazcane Process.

Fibre Board Production from Bagasse.

By EARL L. SYMES.

Many experiments have been made on the production of paper pulp and fibre board from bagasse, but it has remained for Mr. E. ANTONIO VAZQUEZ, a prominent consulting sugar engineer of Havana, to evolve a process in which the fibre board machinery is combined with the sugar making equipment in such a way that both building board and sugar are produced simultaneously. The derivation of the word Vazcane is obvious and quite appropriate, since Mr. VAZQUEZ has originated a novel method for the separation of the sugar cane into its two constituents, juice and fibre, with a very high extraction of the sucrose, the results secured in the small factory operated during the past season in Havana being over 99 per cent. sucrose extraction.

It may be recalled that Mr. VAZQUEZ was engaged in the complete electrification of the first sugar factory in Cuba to be so modernized, Central Amistad in 1913, and later in similar work for Centrales Providencia, Gomez Mena and others. He sent a communication dealing with the results of electrification, which appeared on page 569 of the December 1916 issue of this Journal. Since that time he has been occupied with paper mill work and more recently as consulting engineer for several Cuban sugar factories. This wide experience in paper and sugar mill work enabled Mr. VAZQUEZ to develop the Vazcane Process. A review of the United States Patent was published on page 227 of the April, 1929, issue of the *International Sugar Journal.*

This invention is revolutionary in character and of world wide interest and importance, since it is the first commercially practicable method available to every factory owner for securing an additional saleable product from the cane. The value of this building board may in some cases be greater than that of the sugar and molasses now being produced. A fibre board factory purchasing bagasse from the sugar factory does not offer these advantages, since the enhancement in value of the bagasse product is not shared with the sugar factory owner who may receive a little more than the cost of his coal or oil as payment for his bagasse.

Great economies are secured with the Vazcane Process which uses a stone grinding roll and an efficient open diffusion system. The following equipment ordinarily found in a sugar factory is eliminated : all cane mills and crushers, defecators, scum tanks, filter-presses, juice heaters, and bagasse handling apparatus. A bagasse board factory would need all of these in addition to its own plant equipment. The combination of a Vazcane board plant and sugar factory should lead to a reduction in the cost of producing both sugar and building board.

In order to give the reader an accurate conception of the Process an excerpt will be made from the patent review. "This apparatus consists, briefly, in means of separating cane by grinding or abrading it into individual fibres or aggregates of relatively few fibres so small as to be unsuitable for any prior methods of sugar recovery. In combination with this is used a solvent bath in which the comminuted material is dispersed and agitated until the solvent is thoroughly worked into the fibres ; the solvent—or more accurately, the sugar solution—is then separated from the comminuted cane and the latter re-dispersed in a second bath. In this bath the material is again agitated in the same manner as in the first, after which it is again separated. These dispersing, agitating and separating means are repeated as often as is necessary to complete the separation of sugar juice from the cane." The Vazcane Process prepares the cane in one single grinding or

abrading operation so that over 99 per cent. of the sucrose may be recovered, leaving the fibre in an ideal condition for the manufacture of building or insulating board. The recurrent mixing and washing out of the fibres on the counter-current principle beginning with hot condensate produces a clear neutral juice that has been filtered many times through the mats of fibre in the separators, ready for the evaporator.

The small factory near Havana was equipped for the Vazcane Process to produce 5 tons of fibre board per day, grinding at the rate of 50 tons of cane per day. The abrasive roll used measured 20 in. in diam. by 42 in. in length, and was made of sections of medium grit carborundum, bonded together with bakelite to form the cylindrical roll. This was directly connected to a 100 h.p. electric motor with its axis horizontal and operated at 1200 r.p.m. The stalks of cane lying lengthwise to the axis of the stone were fed on to it from a vertical hopper, being forced against the stone by a continuous chain crowding conveyor. The pressure thus exerted was only sufficient to maintain good contact between the cane and grinding stone and would be infinitesimal if compared with the hydraulic pressures used in present milling installations. About one quarter of the surface of the stone is in contact with the cane, the lower part being immersed in a bath of juice which is carried up by the revolving stone, and the de-fibring of the cane occurs in the presence of this liquid as well as that exuding from the cane being ground.

Sufficient lime is added to produce a slight alkalinity and the pulp is pumped from a hopper under the roll to the first mixing box of the diffusing system. The diffusion juice from the first or second separator is pumped at about 15° Brix to the evaporator, that from the other returning to the grinding roll. Twelve separations have been found sufficient to obtain over 99 per cent. sucrose extraction, leaving the cane fibre ready for the beaters where it is mixed with chemicals to give the board resistance against water and insects or fungi. The fibres on leaving the diffuser have the appearance of a matting of whitewash brush bristles, few having a diam. greater than $\frac{1}{8}$ in. From the beaters the pulp at about 1 per cent. consistency is pumped on to cylindrical forming filters, passing thence between endless felts through a series of press rolls to compact the fibre into an endless board of 65 per cent. moisture and about 1 in. thick. This board is cut into 8 ft. lengths, 4 ft. wide, and in larger machines may be turned out in widths up to 12 ft. and any lengths required. The wet fibre boards are rolled into a 20-board hydraulic press where steam is admitted to the hollow platens and drying takes place. Only enough pressure for contact is used on the $\frac{7}{16}$ in. boards which require 55 minutes to dry out to a density of 17·8 lbs. per cub. ft.; the $\frac{1}{4}$ in. thick board is dried in 35 minutes at a pressure of 300 lbs. per sq. in., having a density of 31 lb. per cub. ft. The $\frac{1}{8}$-in. board dries in 20 minutes at a pressure of 400 lbs. per sq. in. and has a density of 62 lbs. per cub. ft. The weight per sq. ft. is then 0·646 lb. for any thickness since the same bulk of pulp is used for each type of board. Due to the uniform small size of the fibres, Vazcane board is stronger, has a smoother surface, a more firmly compacted texture than any board that may be made from ordinary mill bagasse. A much higher yield of board may be obtained in this continuous method of manufacture from fresh pulp since no storage or transportation losses occur and the full fibre percentage of the cane should be recovered as board, an average of 11 per cent. on cane being obtained in the present instance. On this basis the production of insulating board would be about 340,000 sq. ft. surface measure from 1000 short tons of cane with 11 per cent. fibre. Cane

with 12 per cent. fibre would give about 370,000 sq. ft. and so on, each unit of fibre giving about 31,000 sq. ft. of Vazcane board.

The small abrasive roll used in the present plant has a capacity of about 2½ short tons or 200 arrobas of cane per hour. Commercial stones would be 42 in. diam. and 60 in. long, or larger, with a capacity of 10 to 12 tons or 1000 arrobas of cane per hour. A factory grinding 1000 tons of cane or 125,000 arrobas per day would require four grindstones of the smallest commercial size ; by varying the speed of the stone the capacity may be raised or lowered, but without any sacrifice in efficiency such as may occur in multiple milling. The stone requires burring or roughening about once every 48 hours, and when the special burring tool is applied this operation may be performed without delaying the grinding of cane. If a complete stop were made, the burring could be done in thirty minutes. If the stone is allowed to become smooth, the cane may be ground to a powder, a rough surface being necessary for proper comminution. It is estimated that a 42 in. diam., etc., roll should not need replacing until after 5,000,000 tons of cane have been ground on it. The absence of hydraulic pressures and myriad oil-consuming bearing surfaces in the Vazcane grindstones when compared to ordinary milling equipment should eliminate costly delays and expensive repairs ; ball or roller bearings also contribute to reduction of friction and operating expense.

In adopting the Vazcane Process the first consideration would be the amount of fuel necessary to replace the bagasse which as a rule is sufficient for all power and heating requirements in the modern cane sugar factory. Some calculations have been made using the following fuel values :—

COMPARATIVE FUEL VALUES.

Fuel.	B.T.U. Per Lb.	Boiler Eff. Per Cent.	Net B.T.U.	Lbs. Water Evaporated per lb. Fuel.	Cost of Fuel.	Value per Ton Bagasse Equivalent.
Coal	12,000	70	8,400	10	$10 ton	$1·94
Oil	18,000	70	12,600	12	$2 bl.	$1·93
Bagasse	3,400	60	2,040	3	$2 ton	

In a study on "The Paper Making Qualities of Hawaiian Bagasse," on page 505 of the September, 1920, *International Sugar Journal*, the pre-war value of a ton of bagasse as fuel is given as 89 cents, a liberal value of $1·20 being used in that work. Two dollars per ton should not be too low a value for our purposes.

From the data secured in the small Vazcane plant the following estimates of the requirements of a cane factory grinding 1000 tons average of cane per day have been made :—

REQUIREMENTS OF STEAM, AMOUNTS AND VALUES OF FUEL NEEDED.

Purpose.	Lbs. Steam.	Barrels Oil.	Tons Coal.	Cost Oil.	Cost Coal.
Pulping	678,240	168·2	33·90	336·40	339·12
Sugar	600,000	148·8	30·00	297·62	300·00
Board	660,000	163·7	33·00	327·38	330·00
	1,938,240	480·7	96·90	$961·40	$969·12
DISTRIBUTION :—					
For Sugar	939,120	232,9	46·95	465·80	469·50
For Board	999,120	247·8	49·95	495·60	499·50
Total	1,938,240	480·7	96·90	$961·40	$969·00

In ordinary milling 1000 tons of cane should produce about 250 tons of bagasse which would have a fuel value of $500 at $2 per ton. The outlay for coal or oil to replace this should not exceed $970 as shown above ; and

another saleable product would be obtained worth somewhat more than the sugar and molasses at present prices, and at a proportionately lower fuel expense than when only sugar and molasses are produced.

The value of the products from a Vazcane Process factory operating in Cuba, with a daily grinding capacity of 1000 short tons of cane, may be estimated as follows :—

VALUE OF PRODUCTS FROM 1000 TONS A DAY VAZCANE PROCESS FACTORY.

Product.	Per Cent. on Cane.	Short Tons.	Unit Price.	Value Per Ton.	Total Value.
Raw Sugar (at 93 Ext.)	11·5	115	2·25 c. lb.	$45·00	$5,175·00
Raw Sugar (Vazcane Dif.) ..	0·7	7	2·25 c. lb.	45·00	315·00
Raw Sugar (at 99 Ext.)	12·2	122	2·25 c. lb.	45·00	5,490·00
Molasses	3·0	30	4 c. gal.	7·00	210·00
Vazcane Board .... (340,000 sq. ft. s.m.)	11·0	110	$20 per M...	61·80	6,800·00
Total value per day of grinding 1000 tons of cane........					$12,500·00

The recovery of raw sugar has been stated in the first place as that normally to be expected under present milling conditions in Cuba, where the average sucrose extraction is about 93. To this has been added the additional amount of sugar, in this case 7 tons, that may be secured when using the Vazcane Process and obtaining an extraction of 99 per cent. of the sucrose in the cane.

An ultra-conservative value has been placed on the board at $20 per 1000 sq. ft. surface measure, since the retail price on similar insulating materials in U.S. and British building centres is $60, and the price at which Vazcane board is selling in Havana is around $45 The duty into the United States from Cuba is only 8 per cent. net on this board. At this low value the board would produce $1100 more per day or nearly 20 per cent. more than the sugar and molasses combined. The 250 tons of bagasse burned in an ordinary mill would appear as 340,000 sq. ft. of building board worth $6800 in a Vazcane Process factory, so that the value of the bagasse would have been increased from $2 per ton to $27 a ton, on a wet fuel basis. The per cent. of fibre or board has been taken at 11 per cent. on cane which is comparatively low, since it has been shown that the average fibre in Cuba is over 12 per cent. on cane. The yield of raw sugar and fibre board may be about the same unless a high fibre cane such as Uba is used. In other words, the mill owning planter who is now getting 2 tons of sugar per acre, worth $90, may expect about 2 tons of fibre board per acre worth some $120, upon securing a licence to operate under the Vazcane Process.

The increased returns indicated should enable the progressive cane planter to adopt many modern mechanical implements which should result in lower labour costs similar to those obtained by such improvements in other mass production industries. In this way sugar cane agriculture may be placed on a sound economic basis, returning a proper interest on capital invested and providing labour with a rising scale of wages instead of the present antiquated system of reducing labour costs by lowering wages. The equipment used in a Vazcane Process factory, while new to the sugar industry, has long been used in the paper mills : grindstones are used to pulp spruce logs ; the separators are standard pulp thickeners consisting of a revolving screened drum on which the pulp is carried out of the bath and dropped into the next separator mixing box ; the board-forming presses are used in the making of cardboard, and the beaters and filters are standard paper factory equipment.

The frequent manipulation of 15-ton mill rolls is eliminated since a grindstone may last thirty years or more.

The market for cane fibre board has been hardly scratched and is world wide in extent. Board is only one of the possible products since the cane pulp may be moulded and dried in a variety of shapes and also used for paper. One-piece shipping containers may be made, and in fact packages suitable for shipping sugar might be made from the fibres that originally surrounded the sugar in the growing canes.

Beet pulp has been profitably used for years, and it seems that cane pulp can now be converted into a valuable product and the progressive cane planter, taking advantage of this new invention, may find his income more than doubled and his economic position correspondingly strengthened.

The Sugar Industry in South Africa.

(By a Durban Correspondent.)

The Outlook.—A variety of causes tends to make the present situation in South Africa anything but reassuring. When the suspended duty of £7 a ton was imposed in 1926 after the conclusion of the Fahey Conference Agreement, it was believed that their home market was assured to South African producers at a price of £24. 10s. a ton for 1st refined, the average price of sugar for the whole crop depending on the proportion of the exportable surplus and the price realised therefor. That competition in their own market should be completely eliminated proved, however, to be too optimistic a hope. With world prices steadily declining, and a large surplus of the 1928 crop unsold, South Africa has recently become the dumping ground of any overseas exporter with sugar which he is prepared to dispose of at any figure. With their own market thus seriously threatened, the industry, represented by both millers and planters, appealed to the Government for the imposition of a dumping duty. The deputation was well received by Minister of Finance HAVENGA, and a dumping duty was levied against Germany and Czecho-Slovakia. America was later added to the list. Hopes again rose high, but again optimism proved premature. Cuban sugar, barred from America, began to be shipped from Canadian refineries and a dumping duty against that country had to be asked for. Then consignments of Dutch sugar began to arrive and this proved the hardest nut to crack, as, Holland b ing a Free Trade country, no dumping duty could be imposed in terms of the Customs Act. The only remedies at present are a complete embargo, which is not popular, or increased protective import duties. These measures can only be put into force by Parliament, which does not meet until February. Meanwhile the price of 1st refined and consequently that of cane are at a low ebb, and the industry still has to supply sugar at pre-duty prices to manufacturers and to pay freight to coast ports, in terms of the Fahey Conference Agreement.

The average price is further lowered by the continued increase of the exportable surplus. The local consumption is in the neighbourhood of 190,000 short tons. The total output, which has been mounting steadily for the past few years, is likely to pass the 300,000 mark for this season, and the exportable surplus, which was 25 per cent. in 1927 and 29 per cent. in 1928, is likely to be 40 per cent. or over for this season. With the world's price at its present low level this will, of course, seriously affect the average price.

The Quality of Cane.—It would be pleasant to record that the low prices were offset by better quality of cane, but unhappily the sucrose content of the cane, due to abnormal rainfall during the growing period, is the lowest for many years. The percentage of sucrose (inclusive of purity bonus) in cane supplied by planters was 13·94 in 1927 and 14·11 in 1928, but it is doubtful whether this season will show an average very much above 13·0 per cent. Purities on the whole have been good and rejections, which last year amounted to 8000 tons, have been negligible to date. Recent estimates show 3,080,000 tons of cane with available sugar of 308,000 tons. However, in order to reap all this amount, it will be necessary for many of the factories to continue crushing operations until late in January, although the experience of past years has shown that the quality of the cane falls off very rapidly in December, and it is not to be expected that planters will continue to send cane to the factories when any considerable portion of it has fallen to the rejection point (9 per cent. sucrose or 78 purity). The question of the curtailment of the crushing season is one that will have to be faced by the industry in the near future. The output is increasing every year—the number of active factories is decreasing, but their capacity is expanding, though hardly keeping pace with the increase of planting. As a result the crushing plants are only able to cope with the total available cane during the best months, provided that all conditions are favourable. This year the ripening of the cane was delayed by late summer rains, then an exceptionally severe outbreak of malaria paralysed both the cutting gangs and the factory staffs just at the time when crushing was starting. Even after the main incidence of the epidemic had subsided, the labour was too weak and exhausted for effective work. Add to this the continual rain delays of an unusually wet winter and spring, and the result is a general retarding of the normal progress of the crop. On September 14th, 48 per cent. of the crop had been crushed, as against nearly 60 per cent. at the corresponding time last year. If all available cane cannot be crushed in time, there remains the knotty problem of dealing with the left-over cane. But let us deal with such difficulties when they arise.

The Prospect of the Future.—It is a truism that prices move in cycles, and the present " down " must eventually be succeeded by its compensating "up." The balance will eventually be adjusted, provided it is possible to tide over the lean times. This can only be done with the assistance of strong capital reserves, or of good credit. The planting side of the industry hardly possesses this reserve. In normal times the credit should have been fairly easily forthcoming for sound and well developed sugar properties, but now comes the third factor in our trinity of troubles. The Prime Minister, General HERTZOG, has recently found it advisable to issue a warning of a coming trade depression ahead. The resultant financial stringency and tightening of credit facilities must be felt severely by the industry at such a juncture, especially when the recently prevailing high price of farms has left recent comers saddled with heavy interest charges on the capital cost of their holdings. However, there is no cloud without its silver lining, and several recent developments promise well for the industry when the present difficulties pass. Foremost amongst these is the undoubted fact that sucrose payment has come to stay. Three years' working of the Fahey Conference Agreement, while bringing to light the usual crop of unforeseen difficulties, has nevertheless proved a practical working instrument, definitely established for the next seven years and almost certain to be renewed in one or other revised form at the end of that period. The uniformity of procedure thus

attained is of great benefit in stabilizing and standardizing cane purchase agreements, and whatever may be the defects of the scheme, neither miller nor planter is likely to seek a reversion to old weight basis of payment. The next bright spot is the very definite advance of the factory plants in manufacturing efficiency during the last few years. In 1926 the average overall efficiency was stated to be 73·5. The average figure for 1928 was 75·3, the improvement, however, being very much more marked in the larger plants, several of which showed efficiencies of over 77, which is good for Natal, though it shows that we have still a long way to go before we can compare favourably with the leading sugar countries, such as the Hawaiian Islands, Cuba and Java. The principal advances have been in the direction of better preparation of the cane for milling, by the installation of shredders and double crushers. Also mill trains have been lengthened in several cases by the addition of extra units. Evaporating efficiency has been improved by the use of large pre-heating vessels from which extra vapour is drawn for heating and boiling. Other improvements have been effected which can scarcely be detailed in such a general survey, but the general tendency is very encouraging.

On the agricultural side, there has been an undoubted improvement in the condition of the cane as delivered at the factories, this being a direct result of the sucrose payment method first introduced with the 1927 season. The improvement is reflected in a great decrease of the quantity of rejected cane, as mentioned above. The search for new varieties continues at the Mount Edgecombe Experiment Station under the able direction of Mr. H. H. Dodds. Small quantities of experimental varieties have been issued to certain planters for trial under normal field conditions. It is hoped to give a fuller survey of these experiments at a later date.

The growing importance of the chemical and scientific side of manufacturing and agricultural processes is at last being realized. The S.A. Sugar Technologists' Association have been doing good work and their annual conference has become an important feature of the South African sugar world.

Finally, an attempt is being made by means of suitable propaganda to break down the prejudice which has existed for many years in the minds of the public against all sections of the industry. A vigorous attempt is being made to increase the local consumption of sugar, especially amongst the natives, who constitute an immense potential market if once they can be induced to acquire the sugar habit. Many difficulties have to be overcome, foremost being the rapacity of country storekeepers, who charge exorbitant prices to natives for inferior grades of sugar. The purchasing power of individual natives is naturally small, and they must not be allowed to be frightened away by unjustifiable profiteering.

Given freedom from any further unforeseen setbacks, the South African sugar industry should come successfully through the present depression and may well look forward once more to a prosperous future.

October 30th, 1929.

Beet versus Cane.[1]—" Java is just closing a campaign in which the average raw sugar produced per acre is 7½ tons; 145 bags (hundredweight) per acre! And we think we do fairly well with 30 to 35 bags average per acre! . . . . This scientific progress is getting underway in Cuba, the Philippines and Porto Rico, our other principal competitors. There will undoubtedly come in the course of time a similar remarkable improvement in yields per acre in these countries."

1 Editorial in *Through the Leaves*, October, 1929, published by the Great Western Sugar Co., of Denver, Colo., U.S.A.

Unirrigated Sugar Plantations in Hawaii.

The papers dealing with the agricultural side, prepared for the Meeting of the Association of Hawaiian Technologists, held in October, 1929, presumably indicate the special trend of the plantation research in the Territory at the present moment. Countless aspects of the work on the irrigated plantations have been and will continue to be discussed ; but considerable attention appears now to be centring around the economic status of the unirrigated plantations as well. Important papers were presented on cane seedlings, the effect of fertilizers on root distribution, weed control by chemicals, the possibility of lessening production costs, besides interesting studies on the manuring of the fields ; but those dealing with unirrigated plantations have been selected for notice in this paper, as indicated in the heading, on the chance that these will prove of wider interest, if not of practical importance, to other sugar producing countries. Most of the research in the cane fields of the Territory is concerned with very fertile land, treated with what may be termed super-irrigation and super-manuring ; and, although of great scientific interest, the results are less capable of application elsewhere. But when the fields are dependent on rainfall alone for the growing of the canes, the practice adopted at once becomes of personal interest to workers in other places, e.g., in Cuba, many of the smaller West Indian islands, Natal, Mauritius, Queensland and even parts of India—all of which experience from time to time hardships from the climatic distribution of the rainfall in the fields, if not actual flood or scarcity.

It is well known that, while the smaller islands of the Hawaiian group, Oahu, Maui and Kauai, in great part make use of irrigation, the much larger island of Hawaii is dependent on rainfall. Its plantations appear to cluster along the narrow margin of its north eastern side. These have recently been roughly divided into "wet unirrigated" and "dry unirrigated" zones, according to the local rainfall, which is described as "sufficient" and "deficient," respectively, for the growth of the sugar cane commercially ; in the latter, as will be seen, the rainfall often leaves much to be desired, as is the case with the countries mentioned above. These two tracts are geographically distinct, the wet tract ranging from Olaa, in the south, to Hakalau, and the dry from Laupahoehoe to Honokaa and to Kohala in the north. As to the causes of this lack of irrigation in Hawaii we are left to draw our own conclusions ; but the orography of the island appears to be the main reason. Hawaii is a great, rugged, volcanic island with a precipitous coast line, culminating in two great mountain masses, Mauna Loa and Mauna Kea, each over 14,000 feet in height, with the very active crater of Kilauea at a lower level. Much of the surface appears to be covered by the out-pourings of these volcanoes, past and present : it is extremely uneven, and the coast line in most parts is high, and all of this militates against the presence of rivers of any size which could be dammed for irrigation purposes, even if any extensive areas in the interior were available for growing the canes.

Most of the two papers printed on this subject, unirrigated plantations, are concerned with plantation research at Honokaa in the dry area. And, as a statement is published on the rainfall on this estate, month by month, for seven recent years, it is worth while in the first instance to study the details somewhat carefully for the sake of comparing them with the rainfall of other countries also without irrigation. The annual rainfall at Honokaa from 1920 to 1926 was as follows, in inches : 40·8, 89·15, 58·7, 92·0, 44·8, 47·9, 42·7 (two wet years and four dry), with an average annual fall of 59·6 inches, which does not appear to be insufficient in itself. But, on analysis, we detect great

extremes. Thus, there was a dry spell of five months, from April to August in 1922, when the average monthly rainfall was only 1·2 inches, and also a wet spell, from November 1921 to March 1922, when the monthly average was 14·6 inches.

The average monthly fall for the seven years, from January to December, works out as follows : 8·0, 4·0, 10·4, 5·0, 1·7, 1·6, 2·3, 5·2, 3·5, 4·2 8·0, 5·7. From these data, we can safely assume that the rains are heavier in the winter and lighter in the summer, a very serious defect, when we remember that the canes should be growing rapidly in the summer and would slow down at this latitude in the winter. The great asset of continental countries in the tropics is that the rains coincide with and indeed are caused by the higher temperature when the sun is overhead ; and any apparent excess in the total for the year is largely offset by the fact that it occurs just when the plant can do with large quantities. A closer examination of the monthly totals in Hawaii, year by year shows, moreover, great variations in the distribution of rainfall in successive years, as will be seen by the following figures for three of the rainy, winter months during the seven years recorded :—

November	4·1	24·8	8·4	3·7	6·5	3·4	5·2
December	3·6	14·1	0·2	18·4	0·8	0·5	2·0
January	3·2	19·0	10·3	13·4	1·4	7·2	1·2

The value of the two rainy years is discounted by their rains being practically useless for the growth of the canes. In each of these three months there has been an excessively rainy year, and a similar peak occurs in the 11·8 inches recorded for August 1923. As these falls are obviously beyond the average expectation for the month, the liberty has been taken to eliminate the four great peaks noted, and to replace them by the average of the remaining six years, which gives the following average rainfall for the months of the year, that may usually be looked for : 5·2, 4·0, 10·4, 5·0, 1·7, 1·6, 2·3, 3·6, 3·5, 4·2, 4·5, 3·1, making a total of about 50 inches of rain during the year, likely to be of influence in the growth of the canes ; with the chance of a heavy rain in August, and heavier outbursts in winter. An excess in August should be of great value, while any heavy rains during winter might easily be the reverse. Enough has been said to justify the classification of Honokaa as a dry unirrigated plantation, in spite of the 92 inches in 1923 and the 89 in 1921 ; for during the period of active growth the position is sufficiently precarious to justify dry farming or other methods of countering the need for rain. Thus the dry unirrigated zone of Hawaii takes its place among the sugar cane countries suffering from occasional droughts, if not of floods. But any closer comparison is impossible, because of lack of knowledge of other factors—the character of the individual falls, natural drainage of the soil, the effect of elevation and wind on the temperature and evaporation—as well as the fact that the canes are, for the most part, about two years in the ground.

The first paper is by the chairman of the section, RAYMOND CONANT, on "Maintaining juice qualities while increasing yields." He points out that hitherto, while means for increasing yields have received a great deal of attention, the prevention of the juice qualities suffering during the process has been very little studied, and commences his paper by quoting verbatim a reply to a questionnaire sent out by him, received from E. E. NAQUIN who, dealing with Honokaa, bases his remarks on the relative distribution of the rainfall referred to above, with added information of the character of the crops reaped during the last six years, i.e., 1921-1926, as follows. In each

year the tonnage of cane and of sugar is given, together with the "quality ratio" of the juice (the number of tons of cane required to produce one ton of sugar) :—

Tons of cane per acre ..	27·7 ..	29·5 ..	27·9 ..	38·0 ..	38·2 ..	38·6
Tons of sugar per acre..	2·56 ..	3·24 ..	2·95 ..	4·01 ..	4·11 ..	4·11
QR or quality ratio....	10·8 ..	9·1 ..	9·45 ..	9·48 ..	9·45 ..	9·37

The following are NAQUIN's conclusions. A long drought is apt to weaken ratoons and thus lead to early replanting, but a dry winter is favoured, because it ensures good growth of young canes during their lowest period, and gives favourable juice qualities in the canes being harvested. Heavy rains in summer are welcomed, as insuring the crop against a severe check during the fastest growing period, and the bad effect, on the canes being harvested, is fully offset by the increased yields of cane. Rainfall in spring and summer increases yield in the ensuing crop, while uniform rain at this period does not greatly affect the quality of the juice. A dry spring and summer lessens the yield considerably, while a wet spring and winter lessens the average quality of the juice of the current crop.

NAQUIN continues : Yields can be greatly increased by using vigorous cane varieties like Uba, the UD's, (Uba by D 1135 seedlings ?) and POJ types, but then one would expect a depression in the average qualities of the juice. An attempt is being made at Honokaa to counter this defect, by growing these vigorous canes on the less favourable soils. And he presents a Table of the results of an experiment, in which Uba and D 1135 (the standard cane) were planted side by side, on good soil, on moderately good soil, and on poor thin soil. In the Table are given the tonnage of canes reaped, tonnage of sugar produced, and quality ratio. The tonnage of canes was throughout greater in Uba, averaging 58·3, to 36·6 for D 1135 ; but these tonnages remained fairly constant in all types of soil, excepting the rather surprising fact that it was least, in D 1135, in the good soil. The quality ratio decreased steadily from the good to the poor soil in both canes, but much more so in Uba than in D 1135, the figures being : D 1135, 10·2, 9·1, 8·8 ; and in Uba, 21·8, 17·9, 10·4. In tonnage of sugar, D 1135, because of its lower quality ratio, easily beat Uba in the good and moderately good soils, but this was reversed in the poor, thin soil. The following are the figures : D 1135, 3·08, 4·76, 4·00 ; Uba, 2·74, 2·85, 5·5.

CONANT, resuming, observes that good juice qualities with increased yields on unirrigated plantations are inseparably linked with the weather ; and he quotes the conclusions arrived at by DAS, after making a thorough study of the statistics maintained on one estate. The influence of temperature and rainfall is well illustrated by the facts that "high temperature in August, September and October, two years previous, and abundant rainfall in August one year previous, are correlated with high yields at the plantations whose records he studied." Also, "High rainfall from February to June of the previous year, and from January to May of the crop year, appears to exert a great influence on the quality of the juice. The high rainfall of the previous year increases the sucrose content, and the high rainfall from January to May of the crop year decreases the amount of sucrose already formed . . ."

The author then proceeds to give a series of results obtained at Olaa (in the wet irrigated zone), comparing yields and juices of D 1135 with two more vigorous canes, POJ 36 and UD 1. The plots were planted at two different elevations, 500 ft. and 1700 ; they were liberally manured, with 200 lbs. of nitrogen, 20 lbs. P_2O_5, and 200 lbs. K_2O, with the addition, at the lower level, of 12 tons of mud press and, at the higher, of 500 lbs. of bone

meal; in each of the varieties compared at least seven separate plots were laid down. The following are extracted from the tables of results: tonnage of canes, tonnage of sugar, and quality ratio, as before.

(1) Mud press at 500 ft.:	POJ 36	101·65	12·62	8·05
	D 1135	55·02	6·06	9·08
(2) Bone meal at 1700 ft.:	POJ 36	80·86	8·90	9·08
	D 1135	63·32	6·50	9·74
(3) Mud press at 500 ft.:	UD 1	92·13	11·11	8·29
	D 1135	46·01	5·47	8·40
(4) Bone meal at 1700 ft.:	UD 1	72·22	8·70	8·30
	D 1135	51·04	6·20	8·24

POJ 36 thus showed greater yields and better juices than D 1135, and UD 1 also gave better yields, with "satisfactory juice" not greatly differing from that of D 1135. Unfortunately, this vigorous cane is susceptible to cane diseases, and therefore not likely to be taken up commercially.

The remainder of CONANT's paper discusses in some detail the efficiency of potash as a manure. Owing to the large number of other local factors having influence, he, however, regards "the effect of fertilizers on yields and juice quality as to a certain extent an open question," and it is not therefore gone into here.

The second paper, by E. E. NAQUIN, on "Variety problems of arid and unirrigated plantations" deals with the past as well as the future. The following three classes of plantations, arid unirrigated, wet unirrigated, and dry irrigated, are compared as to tons per acre of cane and of sugar, during the four years, 1925 to 1928. The following averages have been struck from figures in the Table; arid unirrigated, 39·5 and 4·25, wet unirrigated, 52·72, 5·71, and dry irrigated, 62·12 and 7·52.

NAQUIN remarks "In deciding what should constitute an ideal commercial variety, or varieties, for the arid and unirrigated districts, a number of suggestions present themselves. Among the most important ones are: (1) Should one select as a standard commercial cane a variety best adapted to extremely dry weather, or to optimum moisture conditions? (2) Is it not possible to increase sugar yields per acre per month by further curtailment in the time of a crop with faster growing varieties? (3) Can one variety be grown economically on poor soil as well as on good soil? If not, what combination of varieties can be grown so as to satisfy the most important problems of both field and mill? (4) Is it feasible to commercialize low quality canes for the purpose of weed suppression and increasing output? Such questions may be discussed under various headings, such as fast growing new canes, early closing in, and early maturing varieties."

He points out that the great changes in varieties which have taken place in the arid unirrigated plantations cannot be reviewed too often. Among those which have flourished in the past, in one part or another of this tract are mentioned Lahaina, Striped Mexican, Yellow Caledonia, Yellow Tip and Yellow Striped. Some were abandoned because of disease, while others were kept because they were the best available. The adaptability of the chief varieties tried at Honokaa is illustrated by a Table of the crops reaped from them in 1919, 1921, 1923 and 1925, in a field 1100 ft. in elevation, giving their tonnage of cane and sugar and the quality ratio of the juices. The following are the average results: D 1135, 39·6, 4·35, 9·10,; Badila 23·6, 2·68, 8·79; H 109 21·2, 2·49, 8·51; Yellow Caledonia 14·0, 1·66, 8·39. D 1135 has largely supplanted all the others, and its economic agricultural value has long been recognized.

But at first there was much prejudice against this cane, and similar problems have to be solved regarding the varieties now available, with still better agricultural qualities. It still remains to be seen whether these will further revolutionize the local sugar industry. Changing varieties is a slow process, generally involving different agricultural practice. Alterations in mill capacity are sometimes needed, and it depends on willingness to make the necessary changes, as to whether the new cane varieties will ever be grown commercially.

Views have changed as to the constitution of an ideal cane, for one thinks in terms of "profit per ton of sugar per month of growth. Time has become an important factor," and the question of shorter crops asserts itself, perhaps to be answered by planting faster growing varieties. A photograph is printed of a field with D 1135 and its rivals, about six months old, which closely resembles the pictures one sees of the standard indigenous canes of India and the new Coimbatore seedlings now replacing them. In the dry unirrigated districts of Hawaii, the drift is towards abandoning the old thick canes for "semi-wild" ones, more vigorous in growth but much thinner. But the general opinion appears to be that growing the thinner canes greatly increases the cost of production. To counter these ideas, reference is made to ALFARO's paper printed in the Annual Proceedings of the Sugar Technologists of Cuba, 1928[1]; and the following quotation is inserted by the author: "The cutting of this cane (Uba) is done without difficulty and at a price generally five cents less than that paid for Cristalina. The result is that each cutter makes $2·80 per day, which is very difficult for him to do by cutting Cristalina cane. For this reason they prefer to cut Uba cane, lamenting that there is no more Uba to be cut . . . . Assuming that the colono has 10 caballerias (333 acres) planted, his profit during three years is $1,632·50 from Cristalina and $7,922·00 from Uba." The author points out that ALFARO refers only to "The economical use of Uba cane in soils unproductive for other varieties."

He then gives a Table of the yields and profits of Uba, D 1135, and H 109, grown at Honokaa, the H 109 being of course grown on the best land and the others on the worst. Certain items from this Table are here reproduced, the Uba being grown on 44 acres of 2nd ratoons, D 1135 on 50 acres of 1st ratoons, and H 109 on 20 acres of 3rd ratoons :—

	Tons Cane per Acre.	Tons Sugar per Acre.	Cost per Acre.	Cost of Ton of Sugar.	Net Profit per Acre.
Uba	78·58	5·06	$170·00	$33·56	$125·68
D 1135	41·15	4·39	133·05	30·32	108·69
H 109	40·47	5·18	216·00	41·67	44·12

"As all know, much effort is being spent in trying to curtail the principal items in cost in production. There should be great opportunity to accomplish this to a certain degree by means of faster growing and earlier closing varieties. Weed control can be minimized by lining roadsides, trails, edges of fields, etc., with varieties that suppress weeds effectively. This practice is also of great help in conserving moisture and preventing wind damage alongside these areas."

The author proceeds to refer to another line of work, namely planting varieties according to the character of soil which suits them ; and some very good results have been obtained, as shown by an interesting experiment at Honokaa at 1600 ft. elevation. Six strips appear to have been planted across a field, with a hillock in it, so that each strip passes over level land, slight slope, steep slope, and the top of the hillock, and thus through very different

[1] *I.S.J.*, April 1929.

conditions of soil and moisture. Three of the strips were planted with the standard D 1135, and one each with POJ 36, POJ 213, and Uba : the results of the three D 1135 plots are averaged here. The tons of cane per acre, tons sugar, and quality ratio were determined, excepting at the top of the hillock. Besides averaging the D 1135 strips the Table recording the results is slightly altered so as to take up less space ; but it is interesting to note that the Uba results have already appeared in this paper in a comparison with D 1135, while none of the D 1135 strips is repeated.

		Tons Cane per Acre.	Tons Sugar per Acre.	Quality Ratio.
On level	D 1135	48·8	4·50	10·9
	POJ 36	48·7	4·30	11·3
	POJ 213	53·8	4·27	12·7
	Uba	59·8	2·74	21·8
Slight slope	D 1135	37·6	3·80	10·8
	POJ 36	51·8	4·39	11·8
	POJ 213	55·7	4·88	11·3
	Uba	51·2	2·85	17·9
Steep slope	D 1135	17·5	2·09	8·4
	POJ 36	20·4	2·10	9·7
	POJ 213	29·1	3·31	8·8
	Uba	57·8	5·55	10·4

On the top of the hillock, D 1135 "would not grow," POJ 36 gave under a ton of sugar, POJ 213 gave 2·16 tons, while Uba "grew very well." From which results the author remarks : "It is clearly seen that some varieties may be grown to better advantage than others when planted in their appropriate places in the field."

C.A.B.

Beet Factory Technical Notes.

Oxford Process.—Dr. O. SPENGLER again refers to beet dehydration processes.[1] It would be a fine result, he said, to be able at the exact physiological moment to lift a field of beets, slice them and dry the cossettes without loss of sugar. But considerable capital would be required for the conversion of existing factories into drying factories ; and anyway it would be completely impossible for farmers to harvest the whole of the beet area at the precise time of maturity. In the advertizing literature of the Oxford process, it was stated that the exhausted cossettes of the new method are richer in albuminoid matter than those obtained usually, but no proof of this had been given. It was claimed that there was no loss of sugar in drying, but experiments carried out at the German Institute have always shown one of about 1 per cent., the same result having been obtained in a large German factory shortly after the campaign. A sample of dried slices had an invert sugar content of 3·25 per cent., or 5·5 per cent. of the sucrose. As fresh slices contain about 0·1 per cent. of invert sugar, which on the dried roots would represent about 0·4 per cent., it is clear that notable losses of sugar occur during drying. Dr. OWEN had stated the cost of drying per ton of beets to be 4·5 marks, and the consumption of coal to be 8 per cent. of the weight of the fresh roots ; in other terms, the cost of drying is 22½ pfennigs per centner (50 kg.) of fresh roots. It was claimed that the dose of lime for defecation could be reduced ; but, on the contrary, the extraordinarily strong coloration of the juice would have to be eliminated

[1] *Zeit. Ver. deut. Zuckerind.*, 1929, 79, 507; see also *I.S.J.*, 1929, 267.

by a greater amount of lime. At Eynsham they are treating the juice by carbons to obtain consumption sugar. In fine, even if all the claims were real, the process is not to be considered for German conditions, since the necessary expenses for new constructions would in all cases exceed the advantages realizable.

Sugar in Scums.—It is pointed out by JIRI KAKLEC[1] that in the analysis of unwashed scums the sugar content obtained does not correspond to the amount of sugar which is found in the washings. Almost generally it is found on determining the sugar in the washings and in the unwashed scums that the amount of sugar in the former is double that in the latter. Last campaign this writer carried out two experiments demonstrating this. An unwashed scum press was opened up and samples taken from about 30 different places; this was mixed, and the sugar content in it found by the zinc nitrate method. Three determinations were made, and 11·1, 11·2, and 11·1 per cent. of sugar were thus found. To determine the sugar in another way, 300 grms. of scums were weighed out from the same sample, and digested for three hours at 82°C.; the extract after the addition of a little thymol was evaporated, and placed in a 250 c.c. flask. It gave a direct polarization of 25·5 per cent., corresponding to 63·75 grms. of sugar in 250 c.c., whilst the "saccharization" or dry substance as found by a Kovar-Fric pycnometer was 11·40° Bg. Then the sugar left behind in the residue was found in the usual way with zinc nitrate. Here are the results of the two experiments in grms. of sugar:—

	I.		II.
In the extracts after digestion..........	63·75	..	82·31
In the washed scums after the digestion ..	4·20	..	1·80
Total	67·95	..	84·11
In the scums by the zinc nitrate method ..	33·39	..	31·20
An excess of	34·56	..	52·91

The author suggests that others should take up the investigation of the reason for such a large discrepancy. One may point out, however, that SPENGLER has already published some interesting results in this direction, and has given an explanation for the differences here pointed out.[2]

De-liming Juices.—An appendix to the system of chemical control adopted universally by the beet factories of Czecho-Slovakia, which has just been published,[3] contains an interesting method for the determination of the theoretical amount of soda required for the removal of the lime salts from the juice. It reads as follows: 10 c.c. of an average sample of the first saturation (carbonatation) juice are titrated with 10 c.c. of N/10 acid, with phenolphthalein as indicator; this gives the total alkalinity, which is expressed as CaO per cent. (*a*). In another portion of the same juice, one estimates the content in lime salts, either by titration with soap solution, or otherwise, as may be specified[4] in the official methods, this result being also expressed as CaO per cent. (*b*). In normal juices the total alkalinity of the first saturation juice should be between 0·02 and 0·03, say 0·025 per cent. CaO higher than the lime salts content. In juices which contain more lime salts, the difference of course is smaller; or the alkalinity of the first saturation juice may be even lower than the lime salts content. In such cases the juice alkalinity must be increased by the addition of soda until the content of lime salts exceeds the other by 0·02 to 0·03 per cent. CaO. *Example*: Alkalinity of the first saturation juice

1 *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 53, No. 51, 747-748.
2 *I.S.J.*, 1929, 381. See also CLAASSEN'S new patent, *I.S.J.*, 1929, 440.
3 Separate to *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 54, No. 8. 4 See *I.S.J.*, 1929, 36, 499.

(*a*) 0·085 per cent. CaO; lime salts content (*b*), 0·077 per cent. CaO; necessary alkalinity 0·077 + 0·025 = 0·102 per cent. CaO; hence the alkalinity must be increased by 0·102 — 0·085 = 0·017 per cent. CaO. This corresponds to a dose of anhydrous soda of $0{\cdot}017 \times \frac{Na_2CO_3}{CaO} = 0{\cdot}017 \times \frac{106{\cdot}00}{56{\cdot}07} = 0{\cdot}032$ per cent. calculated on the juice. This corresponds to about $0{\cdot}032 \times \frac{120}{100} =$ 0·038 per cent. on the roots, equal to 38 kg. for every 100 metric tons.

Weather Effects.—From analyses which are annually carried out by the Sugar Experiment Station, Prague, the dependence of the composition of the beet, and indirectly the character of certain sugar factory operations, on the weather during the beet growth is becoming significant. Thus, in the case of years in which the rainfall is above the average (about 360 mm.) the alkalinity of the juice during evaporation holds up well, and lime salts remain low. On the other hand when the precipitation is less than the average there is a tendency for the alkalinity to decline during evaporation, and the more so the dryer the season. This has again been confirmed by Dr. JAR. SOUCEK.[1] In Bohemia the rainfall was 351·5 mm., whilst in Moravia during the same year it was only 301. In Bohemia only a relatively slight fall of alkalinity was noticed during the campaign following, but in Moravia where a drought had prevailed, this phenomena prevailed. Right at the commencement of the campaign it was necessary to add soda, and in large amount, viz: 5 quintals per 8000 quintals of roots.

Juice Heating.—ERNST THIELEPAPE and PAUL MEIER[2] publish the information that they heat under pressure their carbonatated juice to a temperature of 116-120°C. before it goes to the evaporators. This treatment effects no purification, and no calcium carbonate is thrown out of solution, but it eliminates carbon dioxide from the bicarbonates and from the decomposition of certain non-sugars. Sucrose is not affected, as careful experiments have fully proved. The advantage of the heating is that CO_2 is prevented from passing into the feed-water, and corrosion in the high-pressure boilers used in the factory concerned, viz., Maltsch-Dietzdorf, Germany, is thus avoided.

Carbonatation.—What occurs in carbonatation? Dr. B. BLOCK assumes that the process is one of regular crystallization, as in sugar graining. On the other hand, Dr. H. CLAASSEN holds[3] that the calcium carbonate does not appear as crystals, rather as amorphous particles, though later crystals may develop from this slimy nucleus. The question has now been further studied by T. BREDT[4] in Dormagen s.f., and microscopic investigations now show him that the precipitate from the carbonatation tanks contains (1) tiny spherical bodies, (2) particles of slime, and (3) crystals of calcium carbonate. Regarding the first constituent, these spheres consist of colloidal particles surrounded by a shell of calcium carbonate, sugar being present in them, partly as such, and partly as a calcium saccharo-carbonate. It is held that the carbonatation of beet juices is not so much a precipitation or crystallization process, rather is it a matter of the dehydration of the particles of slime.

Effluents.—Regarding the matter of the purification of beet sugar factory waste-waters, it is worth noting the announcement of MAX LEVINE and G. H. NELSON[5] that at the Mason City, Iowa, plant of the American Beet Sugar Company, unsettled pulp water was experimentally treated by the

[1] J. VONDRAK and B. ZIMMERMAN: *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, 53, No. 40, 513-519.
[2] *Zeitsch. Ver. deut. Zuckerind.*, 1929, 79, 316-326.
[3] *I.S.J.*, 1920, 522. [4] *Zeitsch. Ver. deut. Zuckerind.*, 1929, 285-315.
[5] *Sewage Works Journal*, 1928, 1, 40-45.

stream-flow aeration method, as previously employed by JENKS and LEVINE.[1] "Very satisfactory and promising results" are claimed to have thus been obtained, and a full size plant is being designed for later trials.

Boiling up Juice.—A question often debated is whether the clarified juice should be boiled up before entering the evaporator, and again, if it is so to be treated, whether it should be filtered or not before this boiling. V. STANEK and P. PAVLAS, officials of the Prague Sugar Experiment Station,[2] found it advantageous to boil up the unfiltered rather than the filtered juice, less incrustation being formed, and more loose precipitate. They believe this effect in preventing incrustation to be due to the slimy particles present in the unfiltered juice, and they obtained a yet better result by adding aragonite. Boiler water treated with 0·01 per cent. of aragonite threw out of solution solids rather in the form of a sludge than as an incrustation, especially when much gypsum was present.

New Clarification Process.—A new method of clarifying beet juice has been patented by Dr. H. FREIDRICH, of Prague.[3] It is intended to economize in lime, and to provide a by-product having a certain fodder value. Juice is treated with a minimum quantity of lime necessary for its defecation, namely about 0·25 per cent. of the roots, following which it is heated for a short time to a temperature somewhat above 100°C., in practice to about 108°C. under pressure. A precipitate which is readily filtrable, or can be easily separated in centrifugals, and has the following composition is obtained : dry substance, 34·5 ; ash, 9·04 ; organic matter, 25·46 ; sugar, and organic non-sugars, 13·56 per cent. The clarified juice is clear, light yellow, and has the qualities of a double saturated thin-juice.

Alkalinity of Raw Sugars.—Measurements using a conductivity apparatus, and also direct determinations of the CO_2, show the alkalinity of raw sugars to be due to basic substances mostly exerting a buffering effect. Carbonates are present to the extent of from ½ to ⅓. In determining the *pH* of the sugar, 8 grms. are dissolved in 20 c.c. of water, and mixed with 10 drops of an 0·3 per cent. solution of the indicator, p.p., b.t.b., or other, and this tube compared with that of buffer tubes in a Walpole colorimeter. Sugars at 8·0 to 8·6 *pH* are moderately alkaline ; at 7·0 to 8·0 they are slightly so, and are not suited for long storage. But anywhere under 7·0 they are liable to inversion on storage.

Beet-top Drying.—Utilization of all residues from beet sugar manufacture being the order of the day, a firm in Germany, the Babcock Werke, has designed a plant for dealing with beet-tops so as to produce from them a clean fodder with good keeping qualities.[4] Preliminarily, apparatus frees the by-product from dirt, nematodes, and other foreign matter, and washes it, after which it is chopped up, passing lastly into the dryer proper. The fodder obtained is said to possess an excellent food value, its content in easily assimilated proteins being high. It can be baled or packed in sacks.

MAXWELL CRUSHER-SHREDDERS.—Maxwell crusher-shredder installations have been in operation for the past two seasons at s.f. Poppoh, in Java, and at two other factories—Djatiroto and Peterongan—during the present season. The results have been so satisfactory that it is not surprising to learn that s.f. Tjeweng is converting its crusher to a Maxwell patent crusher-shredder for the 1930 crop. Besides these instances in Java, there is the New Savan factory in India which has just acquired a three-roller Maxwell crusher-shredder, that is due to start up this month.

[1] *Eng. News Record*, 1928, 100, 808-813.
[2] *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 53, No. 48, 545-551.
[3] *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 53, 34-36.
[4] *Die Deut. Zuckerind.*, 1929, 43, No. 28, 776-778.

Java Technical Notes.

Hot Liming in Defecation. **J. P. F. Huese.** *Archief, Verslagen*, 1929, Afl., No. 5, 216-222.

During the 1928 crop at the Kawarassan factory, hot liming gave an extraordinarily favourable result. At the commencement of the season the juice as clarified cold in the ordinary was of bad quality, but it was impossible to trace the cause of this, either in the way the lime had been added, or in the way in which the juice had afterwards been heated. Nor was it possible to effect any improvement by varying the *pH*, the juice remaining deep green and rather opalescent : indeed it was so poor that no sharp separation between settled mud and supernatent juice could be made, a defect which had previously been noticed at this factory. Further, there was a dark " fatty " scum on the juice in the clarified juice tanks, and the evaporator juice also showed a dark oily layer ; whilst, moreover, the exhaustion of the massecuites was difficult, and the sugars had a greenish hue. Attempts to improve matters by the addition of phosphate to the raw juice failed. Laboratory experiments, however, had shown that the temperature at which liming was done had much influence since, by gradually raising this, the juice became clearer and clearer with every interval of 10°C., the optimum result being reached at boiling point. These observations were next put into practice in the factory, by heating the juice to boiling, and liming continuously in the defecation pans. Irregularities noted above were then found to disappear, and a nice clarified juice was obtained, the green colour and " fatty" scums disappearing, and the settling taking place normally. Neither the filter-press loss, nor the unknown figure, was higher in this pre-heating process. Further, the exhaustion of the massecuites became better than before. It is, however, mentioned that hot working applied at two other factories, viz., Menang and Sroeni, gave negative results, in fact there cold liming proved better than hot.[1]

Separate Clarification of Last Mill Juice. **P. Honig.** *Verslag van der Vereeniging het Proefstation*, 1928. 211-212.

At Tanggoelangin s. f., which has two milling installations, one four mills, and the other three mills and a double crusher, the juices of the last mills of both installations were pumped over to tanks for their clarification separately from the rest of the raw juice. Unfortunately the test were carried out during the last days of the crop, and it was possible to make only five experiments with sulphitation and one with ordinary defecation clarification. In the first, juice heated to 75°C. was sulphited to 7·8 *pH* (using p.a.n. as indicator), heated in the defecation pan to 85°C., and boiled up before being filtered. In the defecation experiment, the juice was limed to 7·4 *pH*, heated to 95·C., and defecated in the storage tank at 104°C. Each test lasted some hours, and 75-100 hl. of last juice was thus clarified per hour. By using double the quantity of milk-of-lime per 100 Bé. of dry substance in the juice, as compared with that added to the rest of the juice, a good sulphitation resulted, a purity increase of 2° resulting. Filtration was easy even without the addition of kieselguhr. In the case of the single defecation experiment, a good increase of purity was realized, and this juice also was readily filtered, using kieselguhr to the amount of 275 grms. per hl. of juice. In all the filtrations a pressure above 2 atmos. was applied, and good cakes of low polarization were obtained. In 8 hours one treated 5625 hl. of raw juice and 477 of the last juice, using 1·0 instead of 1·4 per cent. of milk-of-lime at 13°Bé., so that in 24 hours the

---

1 Reference is made by the author to M. Bird's article, *I.S.J.*, 1928, 196, entitled " The Removal of Gums by various Methods of Clarification."

economy in lime would have been : 3 × 4 (562·5 + 47·7) = 7322 litres of milk-of-lime ; whereas without separate clarification one would have used : 3 × 14 (562·5 + 47·5) = 25,628 litres. Hence one saved actually : (7322 : 25,628) × 100 = 28·6 per cent. in lime, and a corresponding amount in sulphur.

NEW APPARATUS ON TRIAL IN JAVA FACTORIES. **E. C. von Pritzelwitz van der Horst.** *Verslag van der Vereeniging het Proefstation,* 1928, 156-159.

Hot Maceration.—At the Panggoongredjo s. f. an installation for the Holtzapfel-Steuerwald hot maceration system has been put into operation, by means of which the macerating liquid is returned three times to the bagasse, and afterwards expressed with special rollers. The inclination of the carrier is so chosen that this juice circulation takes place as far as possible by gravity. The trials are not yet concluded. *Cane Carrier.*—At Oemboel s. f. the head mechanic has fixed a lever connexion between the feed roller and the friction coupling of the cane carrier, whereby the carrier can be stopped when the blanket against the feed roller thickens. It has worked very well. *Mitchell Sieve.*—One of these shaking sieves has been tried at the Kedawoeng s. f. for clarified juice, being later put into use for the after-sieving of raw juice, much very fine fibre thus being separated. *Vibrating Sieve.*—The Halle apparatus was tested for raw juice straining at Pesantren s. f., and has done so well that arangements were made definitely to adopt it during next crop in conjunction with the Halle juice lift. *Sulphur Oven.*—At one of the H.V.A. factories a new form of sulphur oven was put into use. Its principle is that the sulphur is first melted by superheated steam in a special tank placed at a convenient height, the molten sulphur gravitating through a strainer down a steam-heated pipe to the oven proper. In this way, the difficulty sometimes experienced with the slow burning of sulphur, owing to the presence in it of bitumen or slag is overcome. It is reported to work very satisfactorily. *Pumps.*—Winterthus centrifugal dry air pumps have been installed with good results at some of the factories of the H.V.A. for evacuating the pans before connexion with the central condensation system. *Sugar Scales.*—The Toledo sugar scale has been installed for the taring of the bags at several factories with very good results, the weighing being rapid and sharp. So well did this scale behave that a concern has installed it in all their factories. *Preheaters.*—At Bantool and Tandjong-Tirto s. f. air pre-heating was tried out to recover from the flue gases some part of the heat which otherwise would have been lost, returning it to the air used for combustion. An appreciable economy in fuel is said thus to have been realized, and this will be reported on later.

EXPERIMENTAL STATION ACTIVITIES. **P. Honig.** *Verslag van de Vereeniging het Proefstation,* 1929, 254-262.

As showing the activity of the Experiment Station, Chemical Section, ably directed by Dr. P. HONIG, following are some of the matters reported on to various factories and concerns controlling factories in Java :—Use of preservatives for juices ; application of indicators ; decolorizing of spirits ; scales and cookers for bagasse analysis ; disinfection of juice tanks ; combating *Leuconostoc* ; electrical conductivity of evaporator condensed waters ; MACMICHAËL's viscometer ; colloid titration ; FOKKËR-VAN HEEL's reflectimeter ; biological losses ; unknown losses ; abnormally high purity of the molasses ; oil content of boiler feed-waters ; difficultly-curing massecuites ;

negative purity difference between mixed and clarified juice; abnormally high value for "molasses obtained per 100"; ripeness determinations; pumps versus juice lifts; etching mill rollers with acid; treating juices with phosphoric acid; centrifuging juices; mud working with kieselguhr; application of decolorizing carbons; liming with saccharate solution; separate working of mill juices; size of press-mud particles; determination of wax in press-mud; filter-cloth examination; monel metal gauze; corrosion in evaporation; treatment of re-melted after-product sugars; LAFEUILLE boiler-crystallizer; rapid-cooling crystallizers; sugar sieves; hygroscopicity in *goedangs*; glassy mass and grey powder from lime-kilns; production of S.H.S. (white sugar); FABER's boiling scheme; Tjebongan method of working; continuous sulphitation; colour deterioration of S.H.S.; SO_2 content of Java white sugar; ultramarine in S.H.S.; colour of sugar with and without ultramarine; iron content of sugar; refining of sugar in Java; fuel value of molasses; acid boiler water; boilers corrosion; potash content of bagasse ash: construction of *goedangs*; analysis of factory water; etc. The more important of these matters have been collected together to form reports which have already or will be later abstracted in these columns.

DETERMINATION OF INVERT SUGAR IN SUGARS, ETC. **M. v. d. Kreke.** *Archief, deel III, Mededeelingen,* 1929, No. 13, 781-787.

During the 1928 crop at the Java Experiment Station, the invert sugar was determined in different types of sugars by the use of LUFF's copper reagent,[1] instead of Fehling's solution, compared with which the new liquor possesses distinct advantages. It permits of a possible accuracy of 0·01 per cent.; it shows no auto-reduction; it is reduced by sucrose to a much less extent; and it is less affected by small variations in the duration of boiling. *Preparation of Luff's Reagent*: 17·3 grms. of cupric sulphate and 115 grms. of citric acid are dissolved in 200 c.c. of water, solution being aided by heating gently on the water-bath; 500 c.c. of crystallized sodium carbonate are separately dissolved, and this solution added to the other gradually with constant shaking;[2] after cooling, the liquid is made up to 1 litre, and after adding 2 grms. of "Hyflo-cel" it is filtered through a folded paper. Previous to the determination, however, the sugar solution is clarified as follows: *Clarification*: 33 grms. of white sugar, 16·5 grms. of raw sugar, or 8·25 grms. of low-grade sugar are dissolved in 100 c.c. of water in a 150 c.c. graduated flask; after adding respectively 0·5 to 1·5, 2, and 2·5 c.c. of 10 per cent. neutral lead acetate, the liquid is made up to the mark, mixed with a little kieselguhr, and filtered through a dry paper; 100 c.c. of the filtrate is caught in a dry 100/110 c.c. flask; and 1·5-4·5, 6, and 7·5 c.c. of a 10 per cent. solution of sodium phosphate (Na_2HPO_4) added; the volume completed to the 110 c.c. mark; the liquid again filtered, and 25 c.c. of each liquid used for the determination.

Determination: Into a 300 c.c. Erlenmeyer flask one pipettes 25 c.c. of the LUFF reagent and 25 c.c. of the sugar solution; some lumps of washed pumice are added to avoid "bumping" during boiling; the neck of the flask is connected with a reflux condenser; and heating is carried out over an asbestos disc having an opening slightly smaller than the bottom of the flask, which is covered with copper gauze. Heating is so regulated that the contents of the flask boils in 3 mins., and ebullition is continued just 5 mins. At the end of this time, the liquid is cooled in running water (the Cu_2O not

1 See SCHOORL: *I.S.J.*, 1926, 165.
2 Note that this order of addition must be observed.

being allowed to come into contact with air); it is mixed first with 15 c.c. of 10 per cent. potassium iodide solution, and then slowly while carefully rotating with 25 c.c. of 25 per cent. sulphuric acid. As soon as the frothing has ceased, one titrates with N/10 sodium thiosulphate solution, using 1 per cent. starch solution as indicator. Following this, in the same manner one carries out a " blank," using 25 c.c. of water in place of the solution of sugar. The difference between the two readings is read in the following table, which takes into account the reducing power of different amounts of sucrose which may be present, the third column being used when analysing low grade sugar, the fourth for raws, and the fifth for white sugars :—

N/10 thio c.c.	Invert Sugar mg. Mgrms.	Invert Sugar mg. 125 grms. sucrose	Invert Sugar mg. 250 grms. sucrose	Invert Sugars in mg. 5 grms. sucrose
1	3·1	2·9	2·6	2·3
2	6·1	5·9	5·6	5·2
3	9·1	8:9	8·6	8·2
4	12·1	11·9	11·6	11·2
5	15·1	14·9	14·6	14·2
6	18·1	18·0	17·6	17·2
7	21·1	21·1	20·6	20·2
8	24·1	24·2	23·7	23·2
9	27·1	27·3	26·8	26·3
10	30·1	30·4	29·9	29·4
11	33·2	33·5	33·1	32·5
12	36·3	36·7	36·3	35·6
13	39·5	39·9	39·5	38·7
14	42·8	43·2	42·7	42·0
15	46·1	46·5	46·0	45·4
16	49·4	49·9	49·4	48·9

MISCELLANEOUS.

USE OF " SUPER-CEL " FOR MUDDY JUICE AND SYRUP FILTRATION. **F. E. Raabe, W. F. Alewijn,** and others. *Archief, Verslagen*, 1929, Afl., No. 5, 228-230. In a discussion on this subject, the following statements were made : Good results were obtained at Ketanen and Sentanenlor factories with " Super-Cel " added to the muddy juice before its filtration in the proportion of 200 grms. per 30 hectolitres. At Pandaan an improvement was observed with a dose of 2 kg. per 1000 litres. At Gesiekan with 200 grms. per 30 hl. a fine result was obtained, it being possible to hold up two of the presses. At some other factories, less satisfactory results were obtained. For the filtration of syrup from the evaporators previous to boiling to white sugar, 0·12 to 0·18 per cent. of the Brix seems a suitable amount, but according to Mr. Elliott, of the Celite Co., the Brix should not be less than 63° otherwise substances remain in solution which later are precipitated in the vacuum pans. —FLUE GAS (CO_2) APPARATUS. **P. Honig.** *Verslag van de Vereeniging het Proefstation*, 1928, 131-132. At Gayam s. f. an ECKARD gas analyser, which gives only the CO_2, is wholly made of metal, and is constructed on the same principle as the " CoCoo " apparatus, was put under test, the results being compared with those found by an Orsat. It has a particularly large potash reservoir (about 5 litres), so that it can be run for some time. Practically constant results were obtained, and it was found to work without hitch. Its construction is such that all parts are easily reached, a great advantage for manipulation, or for minor repairs.

Sugar Boiling in the Raw Cane Factory and in the Refinery.

By F. SALDAÑA-DÁVILA, M.A., B.Sc., San Juan, Porto Rico.

Sugar boiling may be considered as one of the principal operations in sugar manufacture. The large refiner does well to have a specially trained man supervise this part of the manufacturing process, whilst in the raw sugar house if the chemist or superintendent of fabrication is not experienced in sugar boiling matters, it is bound to operate with some difficulty.

The theory of the sugar boiling process, which applies to the raw factory as well as to the refinery, has been adequately discussed by numerous investigators, chief amongst which stand CLAASSEN[1] as the pioneer, and THIEME[2] as the most noted of the recent workers. In practice the art is met with such a variety of circumstances that the writer feels there is still much in the way of perfecting technique, and that research could help in solving everyday difficulties, thus offering more profitable results.

Beginning with quality of material, the sugar man has purity, suspended matter, gums and other colloidal ingredients as the three important factors influencing boiling operations and results. In the raw sugar house, the purities round 85° are considered high and desirable, while those in the neighbourhood of 75° are unsatisfactory. The fact is that purity alone is not the only one significant point, as the suspended matter, but more specially the nature of the gum-colloids not necessarily included in the polarisation-solids ratio, may very markedly affect boiling operations and yield. Five or ten points difference in the purity of a material represents quite a marked difference in yield. This variation may be easily determined by rapid densimetric and polarimetric examination ; but a colloid condition capable of causing as much reduction in yield and a great deal of trouble in the boiling house is not so readily detected. The progress of ripening of the cane can be traced in the field and even can be quite closely predicted by age, season and by weather influences.

Both raw house and the refinery, however, often develop conditions which, due to the difficulty of their measurement and to the little known about them, come as a surprise rendering the liquors extremely viscous, and producing hard-spinning massecuites and low sugar recoveries. These conditions seem to develop more readily the lower the purity of the liquor, but the point the writer wishes to emphasize is that they are in no way related to purity. A solution to the manufacturing difficulties associated with these conditions may be found in a more thorough knowledge of the colloids of impure sugar liquors than we have at present.

Suspended matter is a factor of equal importance to the raw sugar maker and to the refiner, perhaps more so to the latter. Originally, it is derived from unclean cane, poor screening of sugar liquors, and faulty clarification, in some cases it may come from undesirable soil conditions such as from cane grown in heavy clays or low-lying localities.

If the product is raw sugar, the lowest temperature obtained by the average vacuum pump, say, that corresponding to 27 in. of vacuum, is advisable for boiling all massecuites including low-grades. For the granulated sugars of the refinery a higher temperature, 160 to 170°F., is usually employed for the ensuring hardness of grain and appearance. Refinery remelts may be both grained and built up at low temperatures 140°F and under, but in case of calandria pans of large heating surface they should not be boiled too fast as time and temperature influence hardness of grain, and this in a sense

1 U.K. patent 5518 (1900). 2 *Java Archief*, Vol. 34, Nos. 47, 50 ; Vol. 35, Nos. 2, 3, 8, 11, 16 and 19.

also the spinning quality of massecuites. Too fast boiling may also result in slow-spinning massecuites because of false grain formation. For low-grades built on a "cut," about four hours seems to be ample time to develop sufficient hardness and shape of crystal to give good spinning sugar. Low temperatures permit fast boiling and guard against the mass becoming gummy and difficult to purge. Moreover, a lowering of temperature may greatly improve the feeling to the touch and the ease of purging of a mass which is boiling sticky. During the boiling process, however, much experience is required to cool off a low-grade massecuite from, say, 160 to 140°F. and avoid trouble in the centrifugals, particularly with fast boiling pans. Heat and prolonged boiling are less detrimental with high than with low purity liquors.

With the advent of the modern, fast boiling calandria pan the sugar maker is much at an advantage. He can save time boiling low-grades in 4 instead of 6 or 8 hours, and is thus afforded the convenience of materially reducing the equipment. As is above indicated, much care is required on the part of the attendant, as too much heating surface with ample steam on is liable to result in masses that do not work in the centrifugals. Low-grade massecuites should be kept preferably at a fixed coefficient of supersaturation throughout the boiling period ; too low a degree of dilution may prove as dangerous as too high a concentration. Generally speaking, close boiling and ample grain surface are requisites for successful results with this type of sugar.

Size of grain is entirely at the control of the sugar boiler, it being indispensable that the exact quantity of grain be taken at a time, save in special cases such as in refinery softs and perhaps in cube sugar. The graining operation may be conveniently controlled by seeding with sugar dust, the quantity of grain formed depending upon the volume of the seed added, the size of the dust particle, the stage or coefficient of supersaturation of the liquor at the time of seeding the pan ; also, on the manipulation of the pan as regards changes of temperature and feeding with fresh liquor. Seeding the pan produces, as a rule, a much more even grain, and in boiling refined sugar it saves about ten minutes to each strike which is the approximate extra waiting time required in graining for the formation of the full quantity of crystals when seeding is not resorted to.

In refined sugars in particular grain regularity is a matter of considerable importance. The various types of refined sugar are put on the market under fixed requirements as to size of grain. In making fine granulated, for instance, the large grain portion would have to be screened off to be used as remelt or mixed with a corresponding grade of sugar, while if much under-size grain is formed it will mean so much sugar into the sugar dust box.

A certain hardness of grain is required for appearance and economy in refinery work, a condition controlled by both time and temperature, chiefly time. A 1000 cub. ft. pan of refinery liquor boiled in less than 1½ hours usually results in soft, unattractive sugar. Heavy liquors for graining and building up, 65° Brix and over, may be used with fairly satisfactory results provided the speed of boiling is so regulated by adjusting the temperature that the pan takes to boil at least the same time taken by the lower density liquor, preferably a little longer. When the mass is boiled too open, or at a low coefficient of supersaturation, it produces grain which is harder to the touch and grows faster. The larger-size grain is due to the fact that at low concentrations of the mother-liquor a large proportion of the fine grains always present is dissolved out, and the hardening of the grain is the result of time and tempera-

ture as above indicated, the lower the density of the mother-liquor, the longer being the time required to boil off. In low pans, keeping the mass too open may result in gummy strikes, and in false grain at the time of closing the masses.

Largely depending upon the technique of the attendant is the behaviour of the mass in the centrifugals. The larger and more even the grain the better it will work. The grain may be quite small and still work well if it is even ; it may be uneven to a certain point and not offer much difficulty on curing. It is rather the proportion of large and small grains and their individual size that occurring together result in a dangerous condition. The worst cases of false grain seem to be those in which the small grains totally fill in the spaces between the large crystals when the mother-liquor is considered removed, as in centrifuging. The viscosity factor has also a marked influence on the curing of low-grade massecuites. Refinery low remelts may be considered more viscous and difficult to handle at the centrifugals than raw sugar house low-grades, a condition in all probability closely associated with the gum-colloids present in the raw sugar at the time of entering the refinery, or developed during the refining process. If cured immediately upon discharge from the pan, the Brix to which the mass is brought up cannot be carried too far in these low sugars as it may also be the cause of poor spinning, even in the case of well boiled, even-grained masses. Grain size has also something to do with this.

The quality of the sugar primarily depends on the purity of the liquor from which it is boiled. For the best grades of refined sugar a perfectly translucent, water-white liquor largely free from suspended and colloid matter as produced by double diatomaceous earth and char filtrations is indispensable. Rather than colour and purity, it is suspended matter and colloid impurities that affect the attractive, sparkling appearance sought in the best types of sugar.

Finally, upon the ability of the sugar boiler and the expert attention of the superintendent depends the maximum boiling house recovery, indicated by a low purity final molasses, blackstrap and barrel syrup and, in no small measure, the factory yield.

French Sugar Duties.—The French Chamber has just recently passed by 505 votes to 82 a Bill raising the Customs duties on sugar by 40 francs per 100 kg., and reducing the consumption tax by 15 francs.

Home Grown Sugar Consumption in U.K.—Czarnikow calculates the home-grown sugars entered for consumption in the United Kingdom for the period October-September to be, for the year 1928-29, 192,776 tons ; for 1927-28, 187,504 tons ; and for 1926-27, 154,020 tons.

Sugar Consumption of Europe.—Dr. Mikusch estimates the European sugar consumption for 1928-29 at 9,902,000 metric tons, raw value, as compared with 9,595,000 tons in 1927-28, and 8,655,000 tons in 1926-27. This shows an increase over 1927-28 of 4·03 per cent. and over 1926-27 of 15·33 per cent. (See page 685.)

Dr. Wm. L. Owen.—This well-known bacteriologist, who has done much useful work on the deterioration of raw sugars during storage, has resigned his position with the Louisiana State University, in order to engage in consultation work. Dr. Owen's considerable knowledge and experience of problems connected with industrial fermentation and food preservation are therefore now offered to commercial concerns, and no doubt the opportunity will be utilized by many.

British Beet Sugar Campaign, 1928-29.

The following is a summary of the recently revised results for Great Britain of the 1928-29 beet sugar manufacturing season as compared with the previous year, as published in the *Journal of the Board of Agriculture* (November, 1929). The figures are of particular interest, as 1928-29 was the first year of the new rate of subsidy. It will be observed that the acreage under sugar beet declined sharply from 232,918 acres in 1927 to 178,049 acres in 1928. This lost ground has, however, been almost completely regained this year, the preliminary returns for June 4th, 1929, showing the acreage under sugar beet as 230,900.

	1928-29.		1927-28.
Acreage under sugar beet	178,049	..	232,918
Average yield per acre (tons)	7·69	..	6·45
Number of beet growers	26,291	..	33,340
Number of factories	19	..	19
Average number of days worked	72	..	106
Number of workers employed in factories during the campaign	8,172	..	9,022
Tonnage of beet delivered to factories	1,369,781	..	1,503,019
Average sugar content of beets (per cent.)	17·4	..	16·1
Average price paid per ton of beet	51s. 11½d.	..	55s. 4½d.
Estimated total sum, including cost of transport, paid by the factories to the growers	£3,559,000	..	£4,147,000
Total production of sugar (cwt.)	3,904,194*	..	3,802,189
Average extraction of sugar expressed as a percentage of beets delivered to factories	14·2	..	12·6
Average extraction of sugar expressed as a percentage of total sucrose in beets	82·0	..	78·5
Average farm output of sucrose per acre of beet grown (lb.)	2,995	..	2,330
Average factory output of commercial sugar per acre of beet grown (lbs.)	2,456	..	1,828
Production of by-products :—			
Molasses (cwt.)	975,934*	..	1,144,525
Pulp (Dry (tons))	97,451†	..	91,436
(Wet (tons))	8,208†	..	16,163
Subsidy paid :—			
Sugar	£2,534,507*	..	£3,705,005
Molasses	£289,091*	..	£509,055
Total	£2,823,598*	..	£4,214,060

* Subject to slight adjustment.
† Excluding the production of the desiccation process factory at Eynsham.

SOLIDIFIED CO_2.—Solid carbon dioxide, the by-product gas obtained in the fermentation tanks of distilleries, is now an article of commerce in America. It is described as a "perfect refrigerant," and will soon be available for sale for general and household purposes.[1] It is obtained by cooling to 114° below zero, and the process of doing so is said to be simple and economical.

SULPHUR.—That some of the roll sulphur on the market as offered for use in sugar manufacture is unsuitable is apparent from the recently issued Report of the Java Experiment Station.[2] In general the samples examined contained too much ash and bituminous substances, which adversely affect their burning qualities. All the samples sent in contained sulphuretted hydrogen.

[1] *Chemicals*, 1929, 32. No. 16, 5. [2] *Verslag van het Proefstation*, 1928.

Publications Received.

Filtration and Filters. J. A. Pickard, B.Sc., F.I.C., A.R.C.S.; with a Section by A. J. V. Underwood, M.Sc., A.M.I.Chem.E. (Ernest Benn, Ltd., London). 1929. Price : 45s.

Filtration is applied in practically every type of chemical manufacture, and in consequence the variety of forms of filtering plant is very great. In this book, Mr. PICKARD, whose name is well known in connexion with the subject, deals with it in a more comprehensive manner than has been attempted heretofore. He has a preliminary theoretical chapter on the " Mechanical Basis and Laws of Filtration " in which part of the book is found a contribution on the mathematical aspects of filtration by a well-qualified writer, viz., Mr. A. J. V. UNDERWOOD. Mr. PICKARD next describes types of filters, including filter-presses, pressure filters, vacuum filters, and filters employing inorganic and organic media (sand and pulp filters). There is a chapter on thickeners. Following this are chapters on the application of filtration in several industries, as those concerning water, air and gases, oils, mixtures of oil and water, sugar, beer, varnishes and paints, sewage, etc. Then one must not omit to mention the chapter on the " Meta " filter, of which Mr. PICKARD himself is the inventor, an apparatus which is attracting much attention at the present time, and has distinct possibilities in the sugar factory and refinery. All this has been really well done. On coming to the chapter dealing with filtration in the sugar factory and refinery, the reader is impressed (considering that the book is a general one) to find such an accurate and well-balanced account of this phase of our industry. It is also interesting to read the views on it of an engineer of such wide experience as Mr. PICKARD, who in effect emphasizes that the problem of the production of refined sugar on the plantation is really one of efficient filtration. This book should do much in the way of advancing the art of filtration in chemical industry generally, and should at once be recognized as a valuable textbook on the subject.

Hydrogen Ions. Hubert T. S. Britton. Volume III.; Monographs on Applied Chemistry. (Chapman & Hall, Ltd., London). 1929. Price : 25s.

A new book on Hydrogen Ion Concentration is certain of being regarded with interest in many branches of chemical industry, of such importance are its applications, and this is surely no less true of sugar production than of any other branch of manufacture. This volume which has just appeared can be pronounced as a skilful compilation of the existing literature on both the theory and the practice of the subject, and it contains data that are not to be found in other textbooks. Electrometric theory and apparatus are well presented; colorimetric methods are carefully described, and there is a special chapter on the errors involved in such procedure. Half of the book consists of chapters on the importance of H.I.C. in different industries; and that on sugar manufacture and refining forms quite a fair account. On the whole the book forms a useful systematic survey of the subject and one which should be found of value in the sugar factory or refinery laboratory.

Fruit Pectin. William A. Rooker. (Avi Publishing Co., Inc., of New York, U.S.A.). Price : $6·00.

Pectin is a product of much interest in America not only for making jams, jellies, confectionery, salad dressings, and the like, but also as an adhesive and emulsifier, for example, in making products containing mineral and vegetable oils. There is no doubt that other industrial uses would be found were its price lower. This small book gives a comprehensive summary of manufacture from apple pomace, and of its commercial applications, in addition to which there is a useful chapter on the patent literature, an important phase of this subject. It is excellently written in non-technical language by one who obviously is an expert practician; and we can commend it without hesitation as a useful account of a comparatively new and promising industry. Pectin is made by steps which in general resemble the main ones of sugar manufacture, viz., extraction, clarification, evaporation, and the possibility of its cheaper production from beet pulp in beet sugar factories given a

sufficient market would be a question worth engaging the attention of research chemists.[1] Pectin juice is purified by treatment with a powerful enzymic preparation, which hydrolyses both the starches and the proteins in a reasonable time, viz., 20-60 min., a process which appears to be worth while trying out on Uba cane juice for the elimination of the starch that has been proved to be present in it, as well as of the uncoagulated proteins.

Carbohydrate Content of Food. R. A. McCance and R. D. Lawrence. Special Report Series No. 135. (H.M. Stationery Office, London). Price 2s. net.

This publication of the Medical Research Council compiles systematic data on the carbohydrates in common foods, and reports the relative food values of different vegetable carbohydrates.

Heat Transfer and Crystallization. W. L. Badger. (Swenson Evaporator Co., Harvey, Chicago, Ill., U.S.A.). 1929.

Prof. BADGER is Director of the Research Department of the Swenson Evaporator Co., and in these six articles he presents points on : The Basic Principles of Heat Transfer (Articles I and II) ; Evaporator Types (Article III) ; Heat Transfer Coefficients in Evaporators (Articles IV and V) ; and Evaporator Efficiency (Article VI). This, in general, is known information, though communicated in a clear and satisfactory manner.

Bulletin of the National Research Council, No. 71. (The National Research Council of the National Academy of Sciences, Washington. D.C., U.S.A.). 1929.

This Bulletin is a supplement to the Bibliography of Bibliographies on Chemistry and Chemical Technology, published in 1925 as Bulletin No. 50 of the National Research Council. Although most of the bibliographies listed have been published since 1924, many older ones have been included so as to make the united publication as complete as possible. Users in search of information should consult both this Bulletin and Bulletin No. 50. Sugar is very fairly represented in this Index.

Prace Centralnego Laboratorjum Cukrowniczego, W Latach 1926-1927. (Nakladem Instytutu Przemyslu Cukrowniczego W Polsce, Warszawa). 1929.

We are impressed not only by the amount but also still more by the quality of the work carried out by Prof. K. SMOLENSKI and his collaborators at the Central Laboratory of the Institute of the Sugar Industry at Warsaw. The opportunity will be taken to abstract the greater part of this later.

Die Zuckeranhydride und ihre Verwendung zur Synthese von Disacchariden. Dr. Amé Pictet and Hans Vogel. (Verlag von Gebrüder Borntraeger, Berlin). 1929. Rm. 7·0 .

This pamphlet, by the two chemists who recently were successful in synthesizing sucrose, is reprinted from the latest edition of EUCKEN'S *Fortschritte der Chemie*. It deals with one of the most recent phases of the chemistry of the sugars, and in particular with the synthesis of maltose, isomaltose, lactose, melbiose, raffinose, etc., from their anhydrides.

The Indian Sugar Industry. By Khan Bahadur S. M. Hadi, Director of Agriculture, Bhopal State. (Published by the author). 1929.

This book describes the production of sugar in the State of Bhopal, and the methods of cultivating native and seedling canes with and without irrigation, as well as methods of sugar making. Experiments carried out by the author are described as having shown it possible to obtain nearly 9 per cent. of first and second sugars from canes containing 14½ per cent. of sucrose.

[1] Beet pulp contains as much as 25 per cent. of pectin. The residue left after its extraction could still be used as cattle food.—ED., *I.S.J.*

Brevities.

New Norwegian Refinery Projected.—Reports have been forthcoming that negotiations had been completed to erect a large sugar refinery in Norway for refining Cuban sugar; but Licht reports that the rumours are at least premature, and that so far it would appear that what has happened is that the Cuban Ambassador has urged the realization of the plan as suitable for Cuban interests.

Sucrose Synthesis.—Some doubt having been thrown on the synthesis of cane sugar recently effected by Pictet and Vogel,[1] these authors have now given[2] very detailed experimental directions for the synthesis. The publication of these details, which were withheld in the first communication, should enable other chemists to repeat the work with more hope of success, and the reality of this important synthesis will no doubt be confirmed.

Vitamins in Cane Juice.—Recently published experiments are reported to have shown that fresh cane juice is lacking in vitamins, *A*, *B*, and *C*.[3] At any rate, feeding experiments failed to indicate the presence of these accessory food factors. These results seem to be surprising, and will probably be doubted by some, seeing that cane molasses was proved a few years ago to be rich in vitamin *B*.[4] Further, one would certainly expect to find some vitamin *C* in a fresh plant juice as that of cane, which has such a considerable food value.

Death of Mr. W. A. McNeil.—We regret to announce the death at a comparatively early age of Mr. William A. McNeil, younger son of the late John McNeil, of the well known Glasgow firm of John McNeil & Co. Ltd., and brother of Mr. Charles McNeil. He was educated at Cambridge and entered the family engineering business as a young man, remaining with it till the time of his death, at which period he had charge of the firm's workshops. He was one of the pioneer workers for the formation of the B.E.P.O. in conjunction with his brother Charles. He was married to the daughter of Mr. Claude T. Berthon, the well known engineering consultant.

Fertilizers used in Java.—In 1928, exclusive of molasses and manure, the use of the principal fertilizers by the sugar industry in Java advanced 7 per cent., increasing from 97,300 tons in 1927 to 104,100 tons in 1928, ammonium sulphate and double super-phosphates being in greatest demand. The following figures show the quantities of the principal fertilizers consumed :—Ammonium sulphate, 97,200 tons; super-phosphate, 100 tons; double super-phosphate, 5300 tons; kapok seed cake, 1500 tons; total 104,100 tons. Other kinds of fertilizers used by the sugar industry included filter refuse, boiler ashes, bone meal and bat manure.[5]

Sulphate of Ammonia.—A process has been developed by Dr. M. R. Tern for the manufacture of this fertilizer in which sulphur dioxide, made by roasting exhausted gas purification mass, is oxidized to sulphur trioxide in an electric arc, and this SO_3 allowed to react with ammonia gas in an electrostatic plant, whereby the sulphate of ammonia is separated. The salt produced is said to be pure white, and in a condition exceptionally suitable for broadcasting; the plant is very simple; it can be installed without great expense in any gasworks; and the cost of production is stated to be decidedly lower than that of ordinary by-product sulphate.

Lime Kilns.—Continuous gas-fired shaft furnaces for burning lime have been greatly improved during recent years, and are now much in favour. Small kilns, making say 5 to 15 tons of burnt lime in 24 hours, have the producer built in conjunction with the kiln itself. These may be provided with an automatic discharging arrangement by which the lime is discharged into railway waggons or upon transporter belts. Using a good quality limestone, the amount of unburnt lime in such kilns does not amount to more than 2·5 per cent., and the fuel consumption as coal should not be more than 15-18 per cent. of the weight of lime burnt, or about 3 cwt. per ton. Labour is reduced to one man per shift.

1 *I.S.J.*, 1928, 547, 669. 2 *Berichte*, June, 1929.
3 "Food Values of Breadfruit, Taro Leaves, Coconut and Sugar Cane." Carey D. Miller. (Bernice P. Bishop, Honolulu, T.H.). 1929.
4 *I.S.J.*, 1925, 139. 5 *Chemical Age*.

PROPOSED DUTCH SUBSIDY.—According to Czarnikow, the proposal to grant to the Dutch sugar industry an adjustable subsidy amounting as a maximum to Fl. 1·50 per 100 kilos, which passed the Dutch Second Chamber in April last,[1] has now been rejected by the First Chamber.

JAMAICAN EXPORT BOUNTY ASKED FOR.—It is reported from Jamaica that the majority of the sugar planters are about to sign an agreement for the co-operative selling of 20 per cent. of the sugar crop locally, the balance to be exported. The Government is being asked to give a subsidy of £2 per ton on export, so as to tide the island sugar industry over the crisis.[2]

SHARPLES CENTRIFUGES.—A bulk machine is now on the market, with diameters of 20, 48, 63 and 65 in., requiring H.P. of 4, 8, 12, 18 and 20. The basket revolves in a vertical plane about a horizontal shaft, and the basket may be either perforate or imperforate, the former being used with a wire gauze or filter-cloth for granular substances, and the latter for semi-colloidal or colloidal material.

A B.E.P.O. NEW SPECIAL COMMITTEE.—The British Empire Producers Organization has just appointed a Special Committee under the chairmanship of Sir EDWARD DAVSON, Bt., with subsidiary committees for each industry represented, for the purpose of framing a statement in regard to the primary production of foodstuffs and certain other agricultural products in the British Empire over-seas to form the basis of representations to be made to H.M. Government and the Imperial Conference of 1930.

INDIAN SUGAR COMMITTEE.—It is now learnt that the Sugar Commission recently appointed by the Imperial Council of Agricultural Research in India has in the course of four sittings dealt with a very wide range of questions bearing on the cane industry, including that of the effect of the imports of foreign sugar on the future of sugar cane cultivation in India. The proceedings were confidential; but an interim report has been prepared and is being submitted to the Imperial Council at its meeting this December.

BEET DEHYDRATION.—Franz Janek[3] points out that an account of an attempt to operate the drying of beet slices as far back as 1835 is to be found in a certain book on agriculture.[4] This venture took place in the Tlumacz of Count Heinr. Dzieduszycki, which had a capacity of 5000 tons in the year. Nothing is said of the construction of the drying houses, of which there were thirteen, nor of their operation. Juice was extracted by the Schüzenbach maceration system. In 1845, however, the factory was reconstructed.

CITRIC ACID.—This vegetable acid, heretofore obtainable only by extraction from the juices of citrous fruits, is now being obtained at the rate of about 2 tons daily in the United States by the fermentation of sugar solutions. It is also being made from beet molasses in Germany by a process based on German Patents 434,729 and 461,356. This production, though admittedly a difficult one, is nevertheless a perfectly feasible technical operation. It is certain sooner or later to exert an influence on the price of the natural acid.[5]

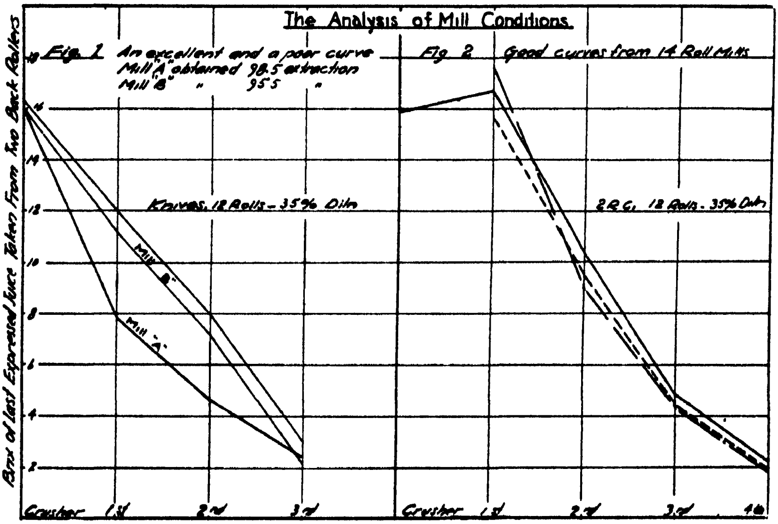
COLOUR DETERMINATION.—Judging colour, even by observers of normal vision, is always uncertain. But there is now a substitute for the eye which is sensitive, invariable in its functioning, and always gives concordant results; namely, the photo-electric cell. By means of it substantially exact determinations of spectral-colour content may be made of a given mixed colour. The only part played in the process by the human eye is limited to taking galvanometer readings. A small number of such readings provide figures which specify the colour under examination in terms of definite wave-lengths.

[1] See *I.S.J.*, 1929, 250. [2] *Financial News.*
[3] *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 54, No. 6, 64.
[4] "Przewodnik po pawilonie Tlumackim na powszechnej wystawie krajowej we Lwowie roku 1894."
[5] *Chemiker Zeitung*; *Chemical Trade Journal*, 1929, 85, No. 2216, 441.

Review of Current Technical Literature.[1]

Analysis of Milling Conditions, using the Brix of the Last Expressed Juice from the Two Back Rollers. **Walter E. Smith.** *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

If one takes samples of juice as expressed by the discharge rollers throughout a milling train which is obtaining satisfactory extraction, a sound basis of reference for future comparison is established, all variables entering into the problem being compensated. In Fig. 1 "Mill A" line shows the average of a group of density tests made at a 12-roller train when the extraction was 98·5; whilst the other lines show similar data at a mill where the extraction was distinctly sub-normal. Comparing the two sets of data, one finds that the crusher juice is practically the same for both mills, but that the last expressed juice is much higher at the first mill of Mill *B*. This is positive indication of deficient extraction by the crusher. The bagasse leaving the crusher in Mill *B* contains a great deal more juice than that in Mill *A*, hence the maceration applied before the first mill is unable to dilute the residual juice to the same density. The general slope of the curve between the first and second mills for Mill *B* is approximately the same as that for Mill *A*, from which we conclude that the work of the first mill is normal. On coming to the final last expressed juice at the third mill, we note a condition which at first glance appears inconsistent, that is,



that the last expressed juice has been reduced to the same density in Mill *B* and in Mill *A*, notwithstanding a difference of 3 per cent. in extraction. The explanation is that in view of the obviously poor work of the previous mills the low density of the last expressed juice is actually an indication of abnormality than good work. This low density was obtained because the bulk of the dilute juice which should have been expressed by the front rollers was passing to the back rollers, hence the low density of the last expressed juice. Fig. 2 shows the averages of juice density tests made at three different mills having two-roller crushers followed by 12 roller trains. At each of these mills the extraction lies between 98·0 and 98·5. These curves may be used as standards of comparison by mills obtaining lower extractions, and the analysis of their own curves will then indicate the general nature of the difference in mill performance. The practicability of this scheme of analysis depends largely on comparison with curves obtained on a specific milling plant under known conditions, preferably with a basic curve obtained when the mill under examination was obtaining

satisfactory curves. It, therefore, becomes the problem of each engineer to obtain these data for himself at his own mill with the assistance and co-operation of the chemist, and to learn to interpret the curves obtained.

CLEANING EVAPORATOR TUBES BY THE SODA AND ACID SPRAY SYSTEM. Lee E. Clarke. *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

Some particulars have been given of this method[1] initiated in Hawaii in 1926, and further details are now presented. It is stated to be in successful operation not only in the T.H., but also in the Philippines and in Mexico, and a number of other factories are planning its installation, the arrangement of which is shown in the illustration. It provides a decided saving in time, fuel, labour and soda. Ordinarily the evaporator bodies have to be filled to the top tube-sheet with caustic soda solution, and boiled up for an hour at least; but now only about 400 gallons of the soda solution are required, compared with 10,000 in the usual method. Scraping is generally unnecessary, and when it is required the scale is soft and easy to remove. First the soda solution (25-35°Bé) is heated up, and the bodies are emptied of all syrup. Hot water is pumped through the spray nozzles to thoroughly wash off syrup adhering to the tubes and the sides.

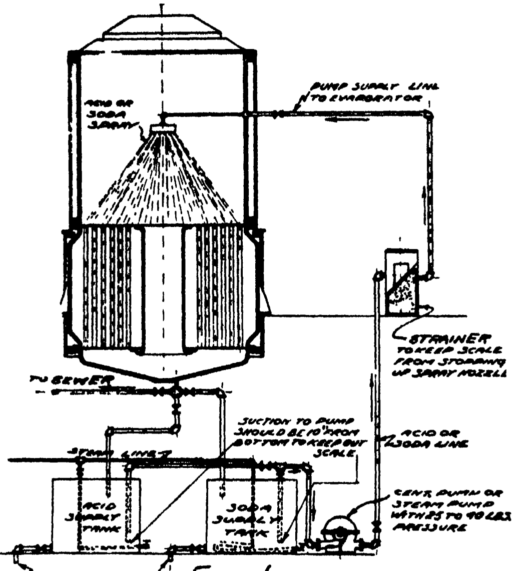


FIG. 1

CLARKE SPRAY SYSTEM FOR CLEANING EVAPORATORS

PATENT APPLIED FOR

After spraying until the scale is softened, the bodies are washed out again with hot water through the sprays, and the wash-water is sent to the sewer. It is not allowed to dilute the stock soda solution, which can be re-used the next week. Then the bodies are filled with clean water, and boiled actively for 15-20 min. to make sure that there is no soda left to neutralize the acid wash which follows. This is done in the usual way with dilute hydrochloric acid, 0·5 per cent., or sour beer from the fermentation of molasses. This boiling should be continued for one to two hours. A pump capable of maintaining a pressure of 60 lbs. at the sprays should be used, and the main header connecting the spray nozzle branches should be 2 in. for 6 ft. bodies, and say 4 in. for 14 ft. cells. It is important to maintain the density of the caustic solution, and its temperature should be kept up to boiling as long as it is in circulation.

OBSERVATIONS ON FORCED COOLING OF THE MASSECUITE IN CRYSTALLIZERS. G. F. Murray. *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

How temperature can be reduced and time saved by the more rapid cooling afforded by water circulation, as compared with air cooling, is shown by some experiments described in this paper. At Paauilo, T.H. the crystalliser equipment consists

1 Patented in the U.S.A., and in Cuba.

of eight cylindrical bodies, each 500 cub. ft., and three of these were fitted with 2 in. coils to permit of water circulation. *Experiment A.* Temperature of massecuite on leaving pan, 63°C.; and temperature in the crystallizer, 60°C. Air-cooling was carried on for 18 hours during which time the temperature fell to 50°C.; then it was lowered to 27°C. by water-cooling in 66 hours, the total time of cooling being therefore 84 hours. Purity of the massecuite, 50·5; and that of the molasses, 30·4° *Experiment B.* Temperature on leaving pan 65°C., and in the crystallizer, 60°C. Air-cooling lasted for 18 hours, the temperature falling to 50°C., and water-cooling for 66 hours to give 28·5°C., the total time thus being again 84 hours. Purity of the massecuite, 50·5, and of the molasses 30·8°. *Experiment C.* Temperature on leaving the pan, 69°C., and in the crystallizer, 66°C. Air-cooling was used entirely, no water being admitted to the coils. Total time of cooling, 96 hours, the final temperature being 33·5°C. Purity of the massecuite, 48·4, and of the molasses, 29·5°C. Hence, it is seen that water-cooling reduced the temperature of the massecuite to 27°C. in 84 hours, or 12 hours less than when air-cooling only was used. Although there was no reduction in the molasses purity, foaming was prevented when water-cooling was followed. Lastly, experiments demonstrating the effect of "ageing" massecuites on drying were described. A portion of massecuite, which had been 96 hours in the crystallizer, was allowed to "age" for 14 days in tanks. On drying this massecuite (Brix 94·0 and purity 51·6) for an hour, a sugar of 69·4 purity and a molasses of 28·5 purity were obtained. On the other hand, a second portion of the same massecuite dried as before used, but without being "aged" was also dried for an hour, yielding a sugar of 51·7 purity and a molasses of 28·6° purity. Applying the S.J.M. formula to these purity figures, one gets theoretical recoveries of 78·3 and 52·5 per cent. respectively. In both experiments the massecuites had the same even grain, and no evidence under the microscope of false grain; yet there was a decided difference in the appearance of the two, that which had "aged in the wood" not being sticky or viscous, whereas the other was very much so. Just what chemical or physical change takes place during the ageing period is not known; but it is an accepted fact that there is a definite limit, somewhere between 10 and 14 days, under which massecuites dry with difficulty.

Regulation of Temperature and Pressure in the Cane Sugar Factory. **G. W. Tompkin.** *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

There seems to be a tendency to cling to hand regulation where automatic control would be far more satisfactory, both from the point of view of decreased labour and efficiency of operation. In the boiling-house, automatic control of the juice-heaters is a decided advantage. First, it eliminates the human element; and second, it ensures a steady even temperature of the heated juice and this without erratic opening and closing of valves. An ideal installation, where exhaust and live steam or exhaust and vapour are used, comprises an air-operated regulator, which instrument controls two direct acting diaphragm valves. One of these may be placed in the exhaust supply to the heaters and be set at the required temperature. The other may be placed in the live steam supply and set to open several degrees lower. If the exhaust steam fails or is insufficient and the temperature drops, the live steam valve opens and maintains the temperature, closing when the exhaust again becomes sufficient. Such an arrangement provides smooth even regulation. Where there is always ample exhaust the single duty type is satisfactory. Temperature regulators should be used for maintaining constant temperature of molasses pumped to the pan floor, where uniformity of both Brix and temperature is desirable. The molasses should come to the pan floor free from grain and of such Brix that it may be boiled straight without the addition of water. Although the Brix must necessarily be governed by hand, the temperature, which is just as essential, should be made automatic. The same holds true for remelting sugar. It is customary in some places to remelt in the pan storage tanks; in others, a small melter is used. No matter how the low grade sugar is remelted, a uniform material should come to the pans. In this case, also, one can put the temperature under automatic control and

thus eliminate one possibility of trouble. In buying automatic temperature controlling instruments it is advisable to select from those which are air-operated; they are steadier in operation and require less adjusting than the self-operating regulator. Perhaps one of the most important aids in the boiling-house is steady uniform steam pressure for the pans. It is unfortunately true that in many plants, even so called modern ones, the pan floor is handicapped with irregular steam pressures. In entirely too many cases the pan floor is the pressure regulator of the exhaust system. It becomes the duty of the pan man, not only to boil, but to act as a human guardian of the exhaust pressure. He finds it necessary to keep an eye on the exhaust pressure gauge lest it get up to the point where steam will be blown to the atmosphere, or drop to a point where a pan will cool and stop. He switches from exhaust to live steam, from live steam to exhaust and back again as the exhaust pressure fluctuates. Since, in the average factory, the exhaust steam is only partly sufficient for heating purposes, some live steam must necessarily be used. If a satisfactory pressure be adopted for the pan floor and a regulator valve be used to maintain that pressure, then the most favourable steam condition possible is available. This, of course, is limited by the back pressure which various pieces of equipment will stand. There are, however, few pumps or engines manufactured in these days which are not designed to run against considerable back pressure, and particularly those designed for factories where the exhaust must be had under pressure for heating.

BOILER FEED-WATER CONTROL AND TREATMENT. **Walter E. Smith.** *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

The usual sources of boiler feed water are pan, first cell, pre-evaporator, and heater condensates. Where these are not sufficient, the balance is made up with outside supplies. It is this additional amount of raw water which introduces the problem of scaling, and frequently also that of corrosion, due to high chlorine content when the water is obtained from saline wells. Either one may use additional condensed vapours, or one may provide chemical treatment for the water to counteract its tendency towards scale deposition. There seems to be a general prejudice against the use of evaporator condensates for boiler feed purposes, but the obvious answer to this is that the cells should be protected against loss of sugar by entrainment in any case. The writer believes that condensate from the second cell of the evaporators should be used as make-up water in preference to raw water from outside sources. Under normal conditions the quality of water in the boilers can be maintained at a very satisfactory standard by adopting a programme of blowing down boilers at fixed intervals (based on laboratory findings) and by complete change of water at intervals varying from two to four weeks. With such a programme there is no need for commercial boiler compounds. The reaction of the water in the boilers may be maintained in the neighbourhood of 8·0 *pH* by the addition of small amounts of soda ash or caustic soda, the amount of which so used will not be sufficient to result in harmful concentration which could cause embrittlement of metal, foaming, or priming. Oil in boilers may result in serious damage, and should receive the closest attention. Separators on the exhaust lines are the best protection against oil entering the boilers, as once the oil enters the boiler feed-water tank the only thing left to do is to remove as thoroughly as possible by filtration. Excelsior filters, bag filters, or any of the special devices offered by manufacturers for this purpose will work quite well if provided with sufficient capacity and properly cared for after installation. Foaming and priming are usually attributed to excessive concentration of soluble sodium salts, sometimes in conjunction with suspended soils. When the water is changed frequently there is little danger of difficulty from these sources. What may be frequently taken for foaming or priming may be caused by sudden demands for steam resulting in excessive flash. There has never been an authenticated case of embrittlement of metal in factory boilers within the Territory of Hawaii, so this phase of the question needs little comment. As yet there is no general agreement between authorities on boiler operation as to its cause. During the past year the writer experimented with conductivity apparatus in an attempt to

devise a system of control which would indicate the presence of slight traces of sugar in condensates, but the results have not been promising. Double distilled water is found to have a resistance of 200,000 ohms; good grade single distilled water has a resistance of approximately 100,000 ohms, while ordinary distilled water as found in sugar factory laboratories will give resistances varying from 25,000 to 40,000 ohms. Sugar-free vapour condensates from juice heaters will give resistance varying from 5000 to 800 ohms. Condensate with an initial resistance of 3000 ohms may be mixed with clarified juice until the polarization of the mixture will be 0·1 per cent., and the resistance will have fallen to 1000 ohms. But this is still higher than the resistance which may be found for sugar-free condensate from the same equipment, thus eliminating the possibility of installing continuous conductivity apparatus set to give an alarm to indicate entrainment when the conductivity falls to some predetermined low point.

STABILIZED STARCH SOLUTION. **M. Starr Nichols.** *Industrial and Engineering Chemistry (Analytical Edition)*, 1929, **1**, No. 4, 215-216. Chemists using iodometric methods will find the following formula of interest for preparing starch solution that will keep indefinitely, and yet is sensitive : To 2·5 grms. of potato starch add about 12·5 c.c. of water, mix to a thin paste, pour with constant stirring into one litre of boiling water (tap or distilled), boil for 15 min. with constant stirring, allow to cool somewhat, and add 1·25 grm. of salicylic acid, stirring till the preservative is all dissolved.—ACTIVATION OF CARBON. **M. and L. Jacqué.** *Chimie et Industrie*, 1929, **22**, 19-23. During carbonization inactive carbon results from the cracking of the hydrocarbons produced; and activation is considered to be the freeing of the groundwork of active carbon from deposits of such inactive material. Activation is brought about by the selective oxidation of inactive carbon. Time and temperature are regulated according to experience, but with air 450° is the limit, and with steam, 900°C. Activating materials, as alkali carbonates, zinc chloride, and the like, reduce the formation of hydrocarbons. The Dorsey and Dressler furnaces are described.—ANALYSIS OF SODIUM HYDROSULPHITE. **R. Feibelmann and W. Meyes.** *Chemiker Zeitung*; through *Chemical Trade Journal*, 1929, **85**, No. 2211, 320-321. Into a narrow graduated cylinder with a ground-in stopper (called a "Hydrosulphometer") is placed 1·0 grm. of the sample, air-free water added to the zero mark, the suspension stirred, and a standard solution of ferric thiocyanate run in until it is no longer decolorized, the graduation then giving the percentage directly of sodium hydrosulphite present. It is stated that the results given by this method closely agree with those found by the indigo process.—CELLULOSE (FOR RAYON OR ARTIFICIAL SILK) FROM BAGASSE. *Technical News Bulletin of the Bureau of Standards, No.* 149, September, 1929. A sample of alpha-cellulose made from bagasse was tested for its suitability for use in the rayon (artificial silk) industry. Alpha, beta, and gamma cellulose, copper number, KOH solubility, ash, and iron determinations were made. From the results of these tests the pulp appears to be quite satisfactory for rayon use, as far as the properties tested are concerned. The alpha-cellulose content was high and the copper number quite low, indicating a high degree of purification. The beta-cellulose content and the portion soluble in caustic potash further bear this out. The beta-cellulose made up the difference between the alpha-cellulose content and the total fibre, and the portion soluble in KOH was less than 3 per cent. The ash content was very low. Some iron was present, but it was a very slight trace.—USE OF THE STAMMER COLORIMETER FOR DETERMINING THE CLARITY OF SOLUTIONS. **Pedro Sengson.** *Sugar News*, 1929, **10**, No. 10, 747-753. The Stammer colorimeter, after being suitably modified, can be used for the determination of sugar solutions, eliminating objectionable features inherent in the Kopke turbidimeter method which gives irregular results, according to the way in which the light is used. In using any type of turbidimeter, the nature of the light (natural or artificial), and its intensity exerts a great influence on the "clarity," which is further affected by the amount and nature of the insoluble matter, *bagacillo*, precipitated salts, sand, and other fine particles.

J. P. O.

Review of Recent Patents.[1]

UNITED KINGDOM.

Production, Revivification and Application of Activated (Decolorizing) Carbons. (*A*) **A.-G. für Stickstoffdünger**, of Cologne, Germany. 315,810; addition to 301,330. July 18th, 1929; convention date, July 18th, 1928. (*B*) **F. W. Meyer**, of Wismar, Germany. 317,017; convention date, August 8th, 1929. (*C*) **Soc. de Recherches et d'Exploitation Petrolifères**, of Paris. 317,047. July 23rd, 1929; convention date, August 9th, 1929. (*D*) **Metallges. A.-G.**, of Frankfort-on-Main, Germany. 313,154. May 15th, 1929. (*E*) **Soc. de Recherches et d'Explorations Petrolifères**, of Paris. 316,222. July 18th, 1929; convention date, July 25th, 1928. (*F*) **Soc. de Recherches et d'Explorations Petrolifères**, of Paris. 316,870. July 18th, 1929; convention date, August 4th, 1928.

(*A*) In the process of the parent Specification for the production of active carbon from the residues from the combustion of coal, lignite, wood and peat, the sorting is effected by elutriation. A sifting treatment may be included before or after the elutriation. (*B*) Used decolorizing carbon is re-activated by treating it, preferably in a moist condition, with steam in a closed vessel. A temperature of 180-300°C. and a pressure of 20 atmospheres may be employed. The carbon may be added to the vessel dry, and then moistened by introducing saturated steam. The vessel may be externally heated by steam or combustion gases. The vessel may also be heated directly by combustion gases or other suitable heating means, instead of by steam. The carbon may be pre-treated with acid or lye, the acid being removed by washing. The re-activated carbon may be washed with water in a filter to remove the substances rendered soluble by the process. The carbon may be converted into a sludge and driven from the vessel by the pressure therein through a lower outlet and a conduit to the filter. (*C*) In the activation of carbonaceous materials suspended in gases, the gases are circulated in counter-flow so that the activation gases emerge relatively cold from the activation retorts. The retorts may be heated internally or externally or both, and the operation may be continuous or discontinuous according as the activation and heating are carried out simultaneously or alternatively. (*D*) Spent adsorptive carbon is regenerated by treatment in a compact mass, in which relative movement of the pieces of carbon is avoided, with gaseous mixtures containing free oxygen, generally in amounts less than 8 per cent. by volume. The carbon may be pre-heated by superheated steam, hot air, etc. The regenerating gas may be preheated to a temperature below 250°C., preferably 120-200°C. When the process has begun, the temperature of the gas may be reduced below that at which oxidation of the impurities begins, for example where mixtures of air and carbon dioxide are employed the temperature may be reduced to normal level. The temperature in the reaction zone is about 500-600°C. The oxygen may be mixed with steam with or without other gases, such as combustion gases. The process may be carried out at ordinary, reduced or increased pressure, the oxygen concentration being varied accordingly. The carbon may be treated in a layer in a heat insulated container, the regenerating gases being passed upwards there-through. An under-layer of readily oxidizable material, e.g. carbon impregnated with substances of low ignition temperature may be provided where the reaction does not commence at low temperatures. The process may be a continuous one, the carbon and the gases being in counter-current flow. A preliminary purification of the carbon with solvents may be included and if inorganic substances which are not readily oxidizable to volatile compounds are present, treatment with acids or alkalies followed by washing with water may be employed prior or subsequent to the actual re-activation step. Examples are given in the Specification of the regeneration of spent carbon from sugar refining, etc. (*E*) In retorts for gas activation, by gaseous exchange through the walls, of carbonaceous material, walls perforated with orifices of circular, lamellate or other shape of

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

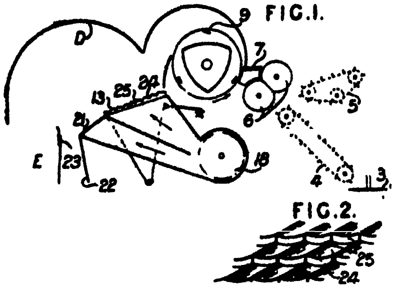
very small diam. or depth, e.g. several millimetres, sufficiently narrow to prevent convection gas currents and inclined so as to exclude carbonaceous material and ashes are employed. The walls may have recesses or undercuts on their inner sides, the perforations opening into the recesses at zones clear of the carbonaceous material and ashes. The retorts may be of tubular shape and of cylindrical, elliptical or polygonal transverse section. Retorts of parallelopiped shape, the height and length of which are for example several metres and the spacing apart of the side walls several centimetres, may also be used. The retorts are placed side by side, vertically or obliquely, in furnaces or ovens, the carbonaceous material to be activated being arranged in the retorts around the outer walls of which are circulated activating gases at high temperature, with which heating gases may be mixed, an interval of some centimetres being provided between the walls of the adjacent retorts. (*F*) To prevent incrustation of the porous refractory walls of retorts used in the gas activation of carbonaceous material by contact of the ashes therewith, the faces of the walls in contact with the material are formed with projecting angles and undercut recesses or with undulations or other means whereby contact between the walls and the material is diminished while the total diffusion surface is increased.

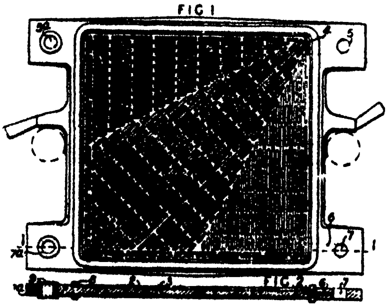
CONFECTIONERY. (*A*) **R. F. Macfarlane, W. E. Prescott, and Baker, Perkins, Ltd.**, of Willesden, London. 313,017. December 30th, 1927. (*B*) **J. Lyons & Co., Ltd., and P. P. M. Slade**, of Cadby Hall, Kensington, London. 314,771. March 26th, 1928. (*C*) **O. Ried**, of Vienna, Austria. 316,264. July 25th, 1929; convention date, July 26th, 1928. (*D*) **E. C. R. Marks (Postum Co., Inc.**, of New York). 317,335. February 10th, 1928. (*E*) **G. R. Baker, Baker, Perkins Ltd.**, and **Anciens Etablissements A. Savy, Jeanjean & Cie., Soc. Anon.** 319,256. June 15th, 1929.

(*A*) Relates to a stencilling machine for applying icing to biscuits, the machine having a horizontal rotary stencil plate with apertures which register, during the application of the icing, with a train of biscuit carrying platforms. The platforms carry means of withdrawing biscuits from a vertical stack and the train of platforms has a course having two straight portions joined at each end by a semi-circular portion, the stencil plate being over one semi-circular portion. The biscuits are supplied to the platforms whilst travelling on a straight part of the course. (*B*) Apparatus for conveying and delivering sweetmeats comprises a conveyor band arranged to overhang a portion of itself so that the goods may be deposited from the overhanging portion on to the lower portion, both portions moving in the same direction, and is characterized by the provision of means for grouping the goods in closer assemblage during their movement towards the point at which they are deposited on to the lower part of the conveyor. (*C*) In the process for increasing the biologic value of fats, etc., in foods, therapeutic substances, and ointments or creams wherein the fats, etc., are exposed to rays of short wave length, ultra-violet rays, or X-rays, mineral substances, such as metals or metallic oxides in pulverized condition are admixed with the fats, etc., either before or after the exposure. (*D*) In a process for treating cocoa beans, the beans are placed in a rotating cylinder with about a quarter their weight of boiling water and are subjected to agitation while being maintained at a temperature of about 120-130°F. for about 20 minutes. The beans are heated in the same vessel at 160-170°F. for half-an-hour under reduced pressure for the purpose of reducing the moisture content of the beans to 1-2 per cent. Now the beans are heated at 223-228°F. and agitated or stirred for the purpose of removing the last traces of moisture and for developing the aroma and flavour of the beans. The beans are rapidly cooled, preferably by suction to room temperature 65-70°F., cracked, degermed and hulled. The nibs are then reduced to the required degree of fineness in a disintegrating and emulsifying device at a temperature of 90-100°F. The cocoa liquor may be fed into a receiver and converted into chocolate in the ordinary manner. The chocolate so produced may be mixed with bran flakes produced by the process described in Specification 217,634. (*E*) A chocolate refining mill is cooled by water, etc., circulated through the rolls by a pump having a valve-controlled cold water supply pipe on its suction side and a discharge pipe on the pressure side. In a modification, the water enters and leaves each of the rolls at

the same end thereof, and a tank having an outlet at its upper end is disposed in the return pipe from the rolls to the pump.

SETTLING TANKS. H. W. Fawcett, of Harrogate. 318,558. March 6th, 1928. A settling tank (for the treatment of wash-waters) is fitted with inclined plates, so that the liquid passes through the tank in thin layers, means for baffling or distributing the liquid as it flows to and away from the spaces between the plates, and a chamber for collecting the solid matter sliding down the places, being provided.—*CANE HARVESTERS. R. S. Falkiner and W. G. Charley, of Melbourne, Australia. 318,674. June 9th, 1928. A cane harvester of the type in which the cane, cut by knives 3, is directed by conveyors 4, 5, to gripping rollers 6 which feed it to cutting mechanism 7, 9, has the chopped up cane and trash discharged on to a screen 13 through which a blast of air is forced by a fan 18 to blow off the lighter trash to a baffle D that deflects it to a discharge E. The screen 13, which is preferably agitated, is formed by a series of stepped layers of curved sections 24, air spaces 25 being provided between the layers. A second screen 21, preferably fixed, is arranged after the screen 13 and through this screen a stronger blast of air is directed to remove any heavier residual trash. The good cane falls down a shoot 22 that is separated from the trash shoot by an adjustable baffle 23. Specifications 251,739 and 314,415 are referred to. (Specifications 284,683, 314,364, and 317,352 also are referred to in the Provisional Specification).—LEAF FILTERS. A. R. Jahn, of King's Cross, London. 318,687. June 18th, 1928. Hollow filtering elements, the cloth sides of which are supported by wire gauze, and rigidly separated by ribbed plates, so as to provide a free space within for the passage of filtrate, are mounted on a fixed head-piece into engagement with which a cover can be brought so as to form a chamber for the reception of material under treatment. The frame of each filter-element is formed by a pipe, the ends of which pass through the head-piece and are provided with cocks. The cloth walls of the element and the supporting gauzes are held apart by corrugated plates, the corrugations being vertical and providing passages for the free flow of filtrate into a pipe for discharge through cocks.—FILTER-PRESSES. F. Philippe, of St. Denis, Paris. 318,794. November 16th, 1928; convention date, October 10th. A filter-press is built up of a single type of plate, which has a recess on one side to receive the liquid to be filtered and grooves on the other for draining to the outlet filtered liquid which has passed through cloth interposed between the grooves and the recess in the adjacent plate. Each plate has an aperture 7 forming part of the supply duct and communicating by a passage 6 with a recess 2. The drainage grooves 3 are arranged in a fan-like manner converging towards a passage 4 leading to an aperture 5 forming part of the discharge duct. Additional supply and discharge ducts may be formed by apertures 7^a, 5^a, in which case alternate plates are connected to one pair of ducts and the other plates to the other pair of ducts. For cleansing purposes the ducts formed by the apertures 5, 5^a may be connected to a supply of compressed air and the ducts formed by the apertures 7, 7^a to a drainage outlet. The filter cloth is held against a trapezium-shaped rubber joint 8. Rubber washers 9 may be placed in those apertures 7^a which are not in connexion with the recess or grooves of the corresponding plate.





UNITED STATES.

MANUFACTURE OF EXTRA FINE SOFT GRANULATED. **Bernard H. Varnau and Truman B. Wayne**, of Sugar Land, Texas, U.S.A. 1,724,627. August 13th, 1929; filed March 21st, 1927; serial, 176,982.

The inventors have discovered that in dealing with certain types of sugar solutions one is to dispense with the step of boiling to grain in vacuum pans by substituting for such step a rapid cooling of a concentrated sugar solution to lower the point of supersaturation of such solution.[1] This may be advantageously accomplished by means of the apparatus now described, which allows the production of sugar having exceedingly fine soft crystals of very uniform character, and eliminates the practical difficulties attending attempts to produce such sugar by the usual vacuum pan process. Also it is possible to utilize the run-off granulated syrups from hot granulated massecuites without first diluting and heating such syrups and returning them for reboiling in vacuum pans. Referring to the accompanying drawing, 10 designates an inner cylinder preferably copper, provided with a funnel-shape outlet 11. Inner cylinder 10 is attached to the outer 12, and a funnel-shaped outlet 13, provided with an opening 13, is secured to 12 and 10. The jacket between the cylinders is divided into two portions 15 and 16 by the annular partition 17. These compartments contain water for cooling the inner cylinder 10. Compartment 15 is cooled by water introduced through 18 and discharged through 19. The lower compartment 16 is provided with a water inlet pipe 20 provided with a valve 21 and an outlet pipe 22. A pipe 32 provided with a thermometer 33 is adapted to deliver the sugar solution upon a scatter plate 34 mounted upon a rotatable spindle 35 within a centrifugal basket 36 also mounted on the spindle 35. The centrifugal basket 36 is provided with a mesh screen 37 having a plurality of openings of the desired size therein. The extension 39 of the cylinder 12 is provided with openings 40 which are in communication with a manifold 41 connected to a suction fan (not shown) whereby a current of air may be drawn upwardly through the opening 13′ in the bottom of the funnel-shaped outlet 13. In the preferred practice of the process a hot supersaturated sugar solution of suitable purity and density is discharged through the pipe 32 on to the scatter plate 34 revolving at a high speed. The sugar solution is thrown outwardly by centrifugal force against the perforated walls of the centrifugal basket 36, being thus forced through the openings in the perforated wall 37 of the basket 36 and against the inner wall of the cooling vessel 10, whereby it is atomized to a fine spray and rapidly cooled by being delivered against the inner wall of the cooling vessel 10. Cooling water is circulated within the compartment 15 to aid and effect this cooling and a current of cold air may also be drawn upwardly through the cooling vessel by means of the fan communicating with the manifold 41. The rate and amount of cooling to be effected depends on the nature of the sugar solution under treatment and is the subject matter of a

Fig. 1.

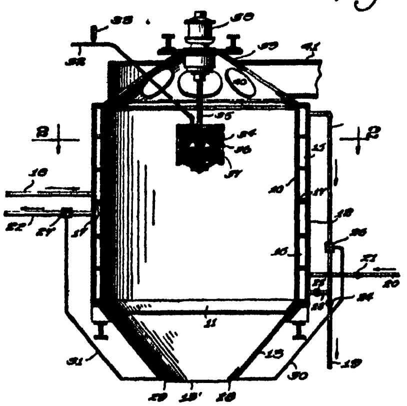
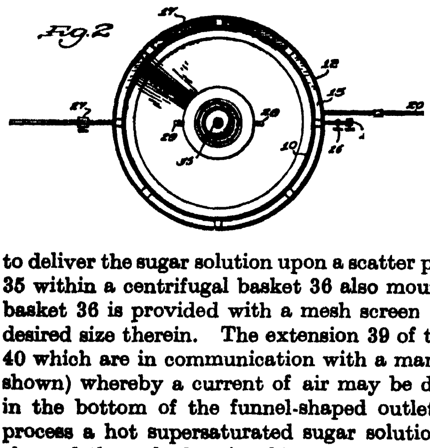


Fig. 2

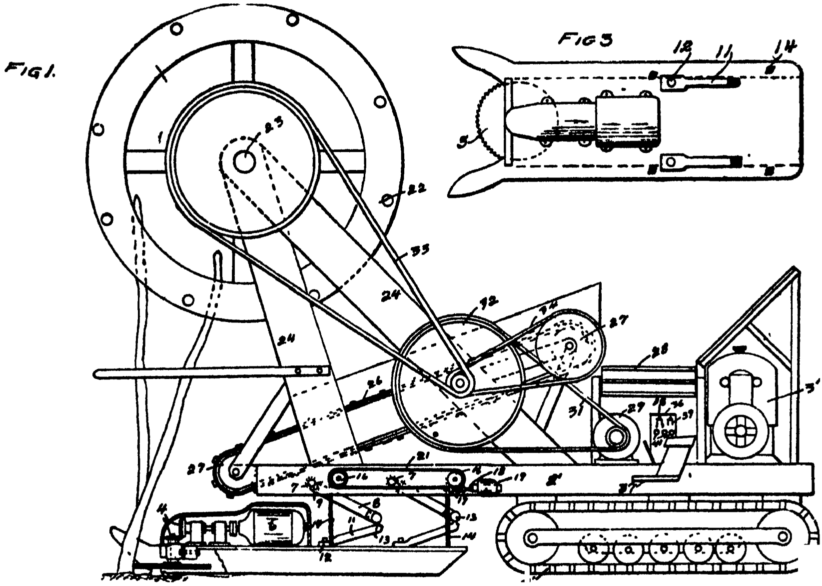


1 See also U.S. Patent 1,715,049; *I.S.J.*, 1929, 418.

co-pending application Serial Numbers 133,594, filed September 4th, 1926, and 133,595, filed September 4th, 1926.[1] As heretofore set forth, the cooling water may either be discharged completely through the upper compartment 15 or may be circulated through the compartment 16. An apparatus of the character described comprising a chamber, a rotatable scatter plate arranged within said chamber, a rotatable centrifugal basket surrounding said scatter plate, means for discharging liquid on to said scatter plate, means for modifying the temperature of the inner wall of said chamber, and means for regulating the extent to which the temperature of said inner wall of said chamber is modified.

CANE CUTTING MACHINE. **Joseph A. and John H. Barrier,** of Oakland, Cal., U.S.A. 1,716,754. June 11th, 1929.

It is a problem to find a cutter the action of which will normally be confined to the space between the two parallel lines previously referred to but will leave its normal path if necessary to include a cane standing away from the row into its operative field. As a practical means for solving this problem the inventors propose to use sleds, the runners of which substantially straddle the roots of the canes and are spaced to bring within its confines the general run of canes on a straight forward motion. The sleds, of which three are shown assembled into one unit, are provided at their front end with outwardly flaring wings 2 which, when the sled in advanced, will strike canes standing alongside of the row and will pull the sled over in the



direction of the cane so as to subject the cane to the action of the disc cutter 3 mounted horizontally under the body of the sled in the front portion thereof and driven through the bevelled gears 4 by the motor 6 which latter is also mounted on the sled 1. Rearwardly of the motor 6, two elbows connect the sled on each side with the front portion of the frame 2′ and more particularly with transverse shafts 7 supported in the front portion of the frame 2′. Each elbow consists of an arm 8 extending downwardly and rearwardly from the shaft 7 and connected thereto for pivotal motion on the axis of the shaft 7 and also for pivotal motion on a pin 9 arranged transversely to said axis, a second link 12 extending rearwardly and upwardly from the sled and pivoted thereto as shown at 12 and a universal connexion 13 between the two links 8 and 11. This arrangement allows the sled to be advanced by the frame 2′ through the two elbows on either side of the sled and allows the

[1] *I.S.J.* 1929, 448.

sled to sway sideways in response to the action of a detached cane on one of the wings 2 so as to bring the latter cane into operative relation relative to the cutter 3. The elbow connexion further allows of vertical motion of the sled relative to the frame 2′ and such motion may be brought about by the unevenness of the ground surface and also by positive operation on the part of the driver through the chains 14 adapted to be wound on transverse shafts 16, one of which is operated by the worm 17 on the shaft 18 of a motor 19 while the other one receives rotary motion from the first one through the chain 12. A reel 22 is revolvably supported on a shaft having bearings in two standards 24 rising from the frame 2′. This reel revolves counterclockwise as viewed in Fig. 1 and engages with the upper portions of the sugar canes facilitating the cutting operation and for pushing the canes after they have been cut on the conveyor 26 running over sprockets 27 and extending rearwardly from the front end of the sleds to deliver stalks to a second conveyor 28 delivering the stalks at the side of the machine. The reel 22 and the conveyor 26 are operated by a motor 29 connected by a belt 31 to a wheel 32 from which latter rotary motion is transferred to the shaft 23 by a belt 33 and to one of the conveyor shafts by a belt 34. The operation of the machine is : The three sleds are arranged to straddle three rows of sugar canes. As the machine advances over the field the disc cutter 3 cuts the canes and the latter are pushed by the reel 22 on the conveyor 26 from which they are transferred to the transverse conveyor 28. If any canes stand outside the normal row of canes they will be caught by the wings 2 which pull over the device toward the side of the stray cane so that the latter is subjected to the cutting action of the disc. If it is desired to move out of the field, the entire sleds may be lifted out of contact with the ground surface by means of the chains 14 and the motor 19.

Beet Loader. **Sueo Terao**, of Mitchell, Nebr., U.S.A. 1,725,112. August 20th, 1929. This includes in combination, a supporting structure, an inclined endless conveyor mechanism mounted on the supporting structure, a frame member on the supporting structure at the lower end of the conveyor mechanism, shovel teeth on said frame, and means between the shovel teeth and the lower ends of the conveyor mechanism for shaking dirt from beets and delivering them to said mechanism, said means comprising a rod supported by the shovel teeth, a crank shaft journaled in the frame to the rear of and above the rod and above the lower end of the endless conveyor mechanism, a plurality of grate bars on the cranks of the crank shaft and having slots to receive the rod.—Glycerin Production by Fermentation. **Frank A. McDermott** (assignor to the **E. I. du Pont de Nemours & Co.**, of Wilmington, Del., U.S.A). 1,725,263. August 20th, 1929. In the production of glycerin by yeast fermentation of a mash containing in solution favourable amounts of a yeast fermentable sugar and material adapted to promote such formation of glycerin, the process is claimed of adding to the original mash during the progress of the fermentation, successive doses of a water solution of said sugar and said material, said doses being of small volume relative to the original mash but of high relative concentration.—Evaporator. **Gustave E. Zeitler**, of Oakland, Cal., U.S.A. 1,721,760. July 23rd, 1929. This describes a horizontal evaporator, having a heating unit in the form of a tubular bundle which may be readily withdrawn from the cylinder of the evaporator for cleaning and repair. Claim is made for : An evaporator comprising a shell for the reception of liquid to be evaporated, a stationary head on one end thereof, a detachable head on the opposite end to give access to the interior, a heating unit insertible in the shell through the end having the detachable head, permanent steam inlet and exhaust connexions on the stationary head and a detachable connexion between said permanent steam inlet and exhaust connexions and the heating unit.—Extraction of Cellulose from Bagasse. **Earnest C. H. Valet** (assignor to **Celulosa Hemmer Valet, Soc. anon.**, of Mexico). Reissue, 17,422 ; original, 1,630,147. September 3rd, 1929. A process for extracting the pure cellulose from the bagasse of sugar cane, consists in first treating the bagasse with a solution of lime, in boiling it afterwards under pressure in a solution of about 6 per cent. of caustic soda combined with a solution of 2 to 3 per cent. of sodium salts until all the foreign matter has been dissolved and separated from the cellulose, in cleaning the cellulose thus obtained with fresh steam after having drawn off the solutions, and in bleaching the pure cellulose.

—SUGAR BEET LOADER. **Fred. W. Amen**, of Sterling, Colorado, U.S.A. 1,726,604. September 3rd, 1929. In a beet loader, a wheeled frame, a gathering mechanism below the forward end of the frame, said gathering mechanism comprising a pair of upwardly and rearwardly inclined side bars diverging outwardly and forwardly with respect to each other, a plurality of longitudinally extending rods between the side bars, means for supporting said rods, a plurality of transverse shafts journaled between the side bars and over the rods, a plurality of teeth projecting from each shaft to swing between the rods, means operatively connecting the shaft together, and means operatively connecting the last mentioned means with the wheels of the frame.—BEET HARVESTER. **Edward F. Sutton**, of Salt Lake City, Utah, U.S.A. 1,727,140. September 3rd, 1929. The combination is claimed with a trailer frame having a rear axle of driving wheels and a steering wheel, of a beet extracting member mounted upon said rear axle and extending forwardly and angularly therefrom and having ploughshares formed at its free end and adapted to straddle a row of beets, means carried by said frame for adjustably supporting the free end of said extractor, a pivotally secured frame mounted in said trailer frame, a beet topper mounted in said last mentioned frame forwardly of and in close proximity to said extractor, crank means for oscillating said beet topper to top the beets in advance of the extractor, roller means carried by said topper for positioning the same relative to the beets, and means for actuating said beet extractor.—FERMENTATION PROCESS. **Johannes Van Loon** (assignor to the **Novadel-Agene Corporation**, Newark, N.J.). 1,727,223. September 3rd, 1929. Yeast fermentations are conducted in the presence of a minute quantity of an organic peroxidized compound. CANE CAR. **John J. McBride** (assignor to the **American Car and Foundry Co.**, of New York). 1,727,661. September 10th, 1929. A car combines : a gate mounted at its upper portion for swinging movement to closed position by gravity and means for holding said gate in closed position comprising latching mechanisms each including brackets secured below the lower edge of said gate, wedge shaped latch elements slidable vertically through the brackets to be wedged therein and to engage the lower edge of the gate, and a rod extending through the latch elements and rotatable to actuate the latter. JUICE CLARIFICATION. **Gerhard E. van Nes**, of Pasoeroean, Java. 1,727,738. September 10th, 1929. Claim is made for the process of purifying sugar juices, comprising the steps of treating the raw juice with lime until it shows a weakly alkaline reaction, then saturating it with an acid gas until it shows an acid reaction, heating the liquid so treated to a temperature not exceeding 60°C., adding a further quantity of lime until the liquid shows a final alkalinity higher than that corresponding to 300 mgrms. CaO per litre in the juice, and decanting the clear juice from the turbid juice.—FILTER-PRESSES. **Rokuro Kogure**, of Kawasaki, Japan. 1,727,832. September 10th, 1929. A means of opening and closing a filter-press combines : a head, a support in alignment with and spaced from said head, a nut carried by said support and aligned with the head, a telescopic strut having one section in engagement with the head and its other section screwed into said nut, means to rotate the threaded section, and means to hold the sections releasably against telescopic movement.—CRUSHER FOR RAW SUGAR IN BAGS. **Wm H. Hoodless**, of Philadelphia, Pa., U.S.A. 1,728,969. September 24th, 1929. In combination with a conveyor for bags of raw sugar of the belt conveyor type : a pair of crusher rollers placed opposite each other at the sides of the belt, and having their axes of revolution vertical, positive driving mechanism driving the same at a circumferential speed substantially equal to the speed of travel of the belt, bearings in which said rollers are rotatively mounted, and mechanism for varying and fixing the distance between said rollers.—PRODUCTION OF ACTIVATED (DECOLORIZING) CARBON. **Charles E. Coates**, of Baton Rouge, La. (assignor to **Oscar L. Barnebey**, of Columbus, Ohio, U.S.A.). 1,729,162. September 24th, 1929. A process of making vegetable char comprises a carbonizing vegetable material (rice hulls, etc.) by destructive distillation ; heating the resultant char in the presence of air at temperatures substantially upwards of 550°C., meanwhile controlling the amount of air to burn out of the char most of the hydrogen and a limited amount of carbon, cooling the char while excluding air therefrom ; treating the char with mineral acid solution ; and drying the char.

Table of Per Capita Consumption in European Countries.

(As compiled by Dr. Gustav Mikusch, of Vienna.)

	1928-29		1927-28		1926-27	
	Consumption in thousands of metric tons raw value	Per capita consumption in lbs. raw value	Consumption in thousands of metric tons raw value	Per capita consumption in lbs. raw value	Consumption in thousands of metric tons raw value	Per capita consumption in lbs. raw value
Germany	1693	57·5	1623	55·5	1521	52·3
Danzig	9	49·9	9	49·9	8	44·6
Czechoslovakia	407	61·8	393	60·0	370	56·8
Austria	209	68·6	202	66·6	176	58·2
Hungary	116	29 7	113	29·2	103	26·9
Switzerland	173	95·5	167	92·4	135	75·0
France	1020	54·3	971	51·9	816	43·8
Belgium	223	61·5	210	58·4	192	53·8
Netherlands	240	68·3	232	67·0	219	64·2
United Kingdom	2111	101·3	2051	98·9	1888	91·4
Irish Free State	112	83 4	109	81·2	103	76·6
Poland	411	29·8	386	28 4	343	25·5
Denmark	198	123·7	183	115 3	170	108·0
Iceland	4	86·5	4	86·5	4	86·5
Sweden	244	88·0	231	83·6	213	77·3
Norway	87	68·3	82	64·6	72	56·9
Finland	93	56·6	88	54·1	74	45·9
Italy	399	21·5	379	20 6	367	20·1
Spain	287	28·2	269	26·6	258	25·7
Portugal (Azores included)	88*†	30·7	86*†	30·3	84*†	29·9
Jugoslavia	117	19·4	90	15·1	94	16·0
Rumania	125*	15·6	122	15·3	119	15·0
Bulgaria	34	13·1	30	11·8	30	12·1
Latvia	50*†	58·2	49†	57·4	42†	49·5
Esthonia	27*†	53·2	27†	53·2	25†	49·4
Lithuania	30*†	28·6	28†	27·0	26†	25·4
Turkey (European and Asiatic)	100*†	15 8	90†	14·4	67†	10·8
Greece	71	25 0	67	23·7	65	23·1
Albania	4*	10·6	4*	10·6	3*	7·6
Europe (Soviet-Union excluded)	8682	49·8	8295	47·9	7587	44·1
Soviet-Union	1300*	19 1	1300*	19·4	1068	16·3
Total Europe	9982	41·2	9595	40·0	8655	36·0

* Estimated. † Calendar Year, 1929, 1928 and 1927.

Sugar Crops of the World.

(*Willett & Gray's Estimates to November 7th,* 1929.)

	Harvesting Period.	1929-30. Tons.	1928-29. Tons.	1927-28. Tons.
United States—Louisiana	Oct.-Jan.	194,000	117,905	63,207
Porto Rico	Jan.-June	680,000	530,116	670,831
Hawaiian Islands	Nov.-June	815,000	825,893	807,180
West Indies—Virgin Islands	Jan.-June	7,000	3,796	10,562
Cuba	Dec.-June	4,900,000	5,156,315	4,011,717
British West Indies—Trinidad	Jan.-June	85,000	89,926	81,551
Barbados	„ „	58,000	66,275	53,106
Jamaica	„ „	60,000	58,450	63,214
Antigua	Feb.-July	15,000	10,945	19,811
St. Kitts	Feb.-Aug.	16,500	13,724	19,443
Other British West Indies	Jan.-June	6,500	7,494	6,141
French West Indies—Martinique	Jan.-July	38,000	37,550	41,879
Guadeloupe	„ „	27,000	4,000	33,462
San Domingo	Jan.-June	375,000	354,085	368,196
Haiti	Dec.-June	14,000	12,497	16,367
Mexico	„ „	180,000	179,124	175,214
Central America—Guatemala	Jan.-June	35,000	32,000	28,792
Other Central America	„ „	58,000	60,000	67,129
South America—				
Demerara	Oct.-Dec. and May-June	110,000	116,578	114,609
Surinam	Oct.-Jan.	12,500	15,000	13,500
Venezuela	Oct.-June	22,000	20,000	19,915
Ecuador	June-Jan.	21,000	22,400	20,091
Peru	Jan.-Dec.	370,000	361,745	370,724
Argentina	May-Nov.	365,000	375,329	421,601
Brazil	Oct.-Sept.	685,000	675,000	649,659
Total in America		9,149,500	9,146,147	8,147,901
British India	Dec.-May	2,650,000	2,735,000	3,216,000
Java	May-Nov.	2,902,000	2,939,164	2,360,079
Formosa and Japan	Nov.-June	885,000	900,334	692,932
Philippine Islands	„ „	725,000	734,483	622,704
Total in Asia		7,162,000	7,308,981	6,891,715
Australia	June-Nov.	516,000	532,034	493,049
Fiji Islands	„ „	85,000	98,683	95,114
Total in Australia and Polynesia		601,000	630,717	588,163
Egypt	Jan.-June	90,000	91,327	89,941
Mauritius	Aug.-Jan.	237,000	247,752	215,555
Réunion	„ „	54,000	52,000	49,972
Natal	May-Jan.	267,000	264,285	219,642
Mozambique	May-Oct.	51,000	90,000	81,250
Total in Africa		699,000	745,364	656,360
Europe—Spain	Dec.-June	....	....	9,000
Total cane sugar crops		17,611,500	17,831,209	16,293,139
Europe—Beet sugar crops†		8,143,000	8,369,526	8,031,874
United States—Beet sugar crop††	July-Jan.	1,000,000	938,640	965,241
Canada—Beet sugar crop††	Oct.-Dec.	32,000	28,857	27,212
Total beet sugar crops		9,175,000	9,337,023	9,024,327
Grand total Cane and Beet Sugar......Tons		26,786,500	27,168,232	25,317,466
Estimated decrease in the world's production	„	381,732	*1,850,766	*1,559,799

* Increase. †† Refined Sugar.

† European Beet Crop Figures are furnished principally by our European Correspondents F. O. Licht.

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1929. Tons		1928. Tons.
Total Receipts, Jan. 1st to November 23rd	3,208,822	..	2,733,053
Deliveries „ „	2,854,861	..	2,715,355
Meltings by Refiners „ „	2,752,650	..	2,626,615
Exports of Refined „ „	81,000	..	95,371
Importers' Stocks, November 23rd	452,192	..	126,238
Total Stocks, November 23rd	619,127	..	203,539
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT OCTOBER 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	3,580,813	..	8 8, 371	..	4,266,692
Stocks	531,142	..	459,519	..	374,364
	4,111,955		3,647,890	..	4,641,056
Local Consumption..	126,000	..	60,130	..	93,950
Receipts at Ports to October 31st ..	4,237,955	..	3,708,020	..	4,735,006

Habana, October 31*st*, 1929. J. GUMA.—L. MEJER.

Beet Crops of Europe.

(*Willett & Gray's Estimates to November 7th*, 1929).

	Harvesting Period.	1929-30. Tons.	1928-29. Tons	1927-28. Tons.
Germany	Sept.-Jan.	1,750,000	1,851,263	1,665,450
Czecho-Slovakia	Sept.-Jan.	1,025,000	1,055,570	1,253,163
Austria	Sept.-Jan.	120,000	107,322	110,020
Hungary	Sept.-Jan.	230,000	220,062	187,600
France	Sept.-Jan.	870,000	904,047	863,206
Belgium	Sept.-Jan.	270,000	279,290	273,113
Holland	Sept.-Jan.	260,000	319,937	250,966
Russia (Ukraine, etc.)	Sept.-Jan.	1,285,000	1,380,000	1,501,986
Poland	Sept.-Jan.	820,000	756,839	566,515
Sweden	Sept.-Dec.	110,000	160,860	145,335
Denmark	Sept.-Jan.	135,000	170,000	142,800
Italy	Aug.-Oct.	425,000	367,334	284,276
Spain	July-Feb.	255,000	250,445	259,964
Switzerland	Sept.-Jan.	6,000	7,300	6,550
Bulgaria........................	Sept.-Jan.	35,000	29,870	42,368
Roumania	Sept.-Jan.	80,000	120,000	139,522
Gt. Britain and Ireland†	Sept.-Jan.	279,000	223,000	208,114
Jugoslavia	Sept.-Jan.	145,000	127,000	77,967
Other Countries	Sept.-Jan.	43,000	39,387	43,959
Total in Europe††		8,143,000	8,369,526	8,031,874

† Refined Sugar.

†† European Beet Crop Figures are furnished principally by F. O. Licht.

United Kingdom Monthly Sugar Report.

Our last report was dated 11th November, 1929.

Prices have continued to fall over the period under review, and sentiment is clearly against the article, and flat depressed markets have been the rule all over the world.

The single selling agency in Cuba has, in spite of this, maintained a firm attitude, and has only made occasional sales from time to time at rather high prices.

The London Raw Terminal Market has been very active, and good business has been doing on the decline. December fell from 7s. 9¾d. to 7s. 0¾d., March declined from 8s. 3d. to 7s., principally on account of tenders of preferential sugars, the prevailing feeling being, that should there be any alteration of the preference in the next Budget the buyers would lose the whole of this. May was not so much affected and fell from 8s. 9d. to 8s. 3d., August from 9s. 2¼d. to 8s. 9¾d. whilst December, 1930, sold from 9s. 4½d. to 8s. 11¼d.

In the White section, business has again been very limited. December sold from 10s. 9d. to 9s. 9d., March from 11s. 1½d. to 10s. 6d., May from 11s. 7½d. to 11s. 10½d., and August from 12s. to 11s. 4½d.

The latest prices are :—

	DECEMBER		MARCH		MAY		AUGUST
Raw	7s. 0d.	..	7s. 6d.	..	8s. 3¾d.	..	8s. 11¼d.
White ..	9s. 10½d.	..	10s. 6d.	..	10s. 10½d.	..	11s. 5¼d.

The trade has only bought from hand to mouth at each decline. The refiners raised their price on the 15th November by 3d. and reduced them by 3d. again on the 2nd December and again 3d. on the 4th, the latest prices being, No. 1 Cubes 26s. 3d., London Granulated 22s. 10½d. The price of Home Grown varies from 21s. 9d. to 21s. 3d. according to factory.

Raw sugars have been very slow of sale, and our refiners have only bought small parcels afloat or near at hand at 8s. 9d. to 8s. 3d. c.i.f. Sugars bearing preference have been practically unsaleable.

With regard to Europe, F. O. Licht has again increased his estimate to 8,239,000 tons against last year's 8,467,000 tons.

Various estimates have been made of the Cuban crop from 4,900,000 tons to 4,300,000.

21, Mincing Lane,
London, E.C.3.
6th December, 1929.

Arthur B. Hodge,
Sugar Merchants and Brokers.

INDEX TO VOLUME XXXI.

GENERAL INDEX.

[(N.C.) implies *Note and Comment;* (Par.) *Paragraph;* (Corr.) *Correspondence;* (Abs.) *Abstract;* (D. O. T. Report) *Department of Overseas Trade Report;* (Am. Comm. Report) *American Commerce Report.*]

General.

NAMES.

PUBLICATIONS RECEIVED.

SUBJECT MATTER.

NAMES.

PATENTS.

SUBJECT MATTER.

NAMES.